SECTION III

NEAR-TERM PLAN FOR SURFACE TRANSPORTATION RESEARCH AND DEVELOPMENT

CHAPTER 1

NEAR-TERM SURFACE TRANSPORTATION RESEARCH: INTRODUCTION

Relationship between Future Plans and Current Activities

In sections I and II of this report, the Department has presented a four-tiered approach to the shaping and implementation of surface transportation research, consisting of the following elements:

- Strategic Planning and Assessment to establish a research framework that embodies National Goals for the transportation system and establishes associated measures of transportation system performance which can be used to prioritize and evaluate related research programs. In sections *II.2.d.i* and *II.6.b*, the report discusses the need for an ongoing commitment to strategic planning of transportation R&D informed by evolving measures of performance.

- Strategic Partnership Initiatives that focus on the aggressive exploitation of rapidly evolving technological opportunities and the introduction of innovative equipment and operations into the transportation enterprise, through leveraging of multi-agency and public/private resources. Chapter *II.3* identifies twelve such partnerships, ten of which relate to surface transportation.

- Enabling Research in areas that support long-term transportation goals and contribute to long-term innovation and offer significant impacts affecting many modes of transportation, but have benefits too, diffuse, uncertain, or far in the future to motivate sufficient private sector investment. Chapter *II.4* presents six enabling research areas which will be particularly important for transportation, and relates these to the Department's previously-stated long-term objectives for surface transportation R&D.

- Transportation Education and Training to assure the continued availability of the highly-qualified transportation professionals and workers upon whom depends the design, construction, operation, and maintenance of the Nation's transportation system, ultimately determining its safety and performance. Chapter *II.5* address the need for training initiatives relevant to mid-career education, vocational training and education, and international transportation curricula building.

The body of activities presented in Section II, which is based upon the recently completed NSTC *Transportation Science and Technology Strategy*, has important relationships to surface transportation research currently conducted with DOT. However, although they in many ways support and enhance ongoing research related to fundamental DOT responsibilities discussed above in *II.2.e*, it must be recognized that these statutory responsibilities require a broad base

of research activities, not all of which can be neatly aligned with a specific initiative or area of long-term enabling research. The elements of Section II call attention to focused areas of unique opportunity. To the extent that these elements arise from and/or support the Department's current research activities, the relationships are indicated in general terms in Table III-1-1.

Program Title *Federal Highway Administration (FHWA)*	Priority Strategic Partnerships*												Enabling Res. Areas**						Educ./ Training
	1	2	3	4	5	6	7	8	9	10	11	12	A	B	C	D	E	F	
Highway Safety	▒												■		■		■	■	
Pavement Research Program											■			■			■	■	
Structures Research Program											■			■			■	■	
Environmental Research							■					■	▒					■	
Right-of-Way Research Program							▒					▒							▒
Policy Research							▒					▒					▒		▒
Transportation Planning Research							■					■			▒		▒	■	■
Motor Carrier Research	■	▒											▒						
ITS -- Research and Development	■	■		▒	▒	■							■		■		■		
ITS -- Adv.Veh.Control and Info. Systems	■	■											■		■		■		
ITS -- Architecture and Standards		■		▒	▒								■		■			■	▒
ITS -- Operational Tests	■	■		■	▒	■									■				▒
ITS -- Evaluation		■					▒					▒	■						
ITS -- Mainstreaming		■			▒										■				
ITS -- Program Support		■													■				■
ISTEA Section 6058 Funds		■																	
Technology Assessment and Deployment	■				▒						■		■		■		■		■
National Advanced Driver Simulator	■												■		■			▒	
Local Technical Assistance Program											■						▒		■
Fairbank Building Renovation																			
National Highway Institute				▒							■			▒			▒		■
University Transportation Centers											▒			▒			▒		■
University Research Institutes											▒			▒			▒		■
State Planning & Research Program											■			▒			▒		■
Strategic Highway Research Program Implementation											■			■			■		■
Eisenhower Transportation Fellowship Program											▒			▒			▒		■
Applied Research & Technology											■			■				▒	
Seismic Research & Development Program											■			■				■	
Timber Bridge Research Program											■							■	
GPS Support				▒											■				

**Priority Strategic Partnerships*

1. *Smart Vehicles and Operators*
2. *National Intelligent Transportation Infrastructure*
3. *Next-Generation Global Air Transportation*
4. *Enhanced Transportation Weather Services*
5. *Enhanced Goods and Freight Movement at Domestic and Int'l Gateways*
6. *Accessibility for Aging and Transportation-Disadvantaged Populations*
7. *Local Environmental Assessment Systems*
8. *Next-Generation Motor Vehicles and Ships*
9. *Aviation Safety Research Alliance*
10. *Total Terminal Security*
11. *Monitoring, Maintenance, and Rapid Renewal of the Physical Infrastructure*
12. *Environmental Sustainability of Transportation Systems*

***Enabling Research Areas*

- A. *Human Performance and Behavior*
- B. *Advanced Materials*
- C. *Computer, Information, and Communications Systems*
- D. *Energy and Environment*
- E. *Sensing and Measurement*
- F. *Tools for Transportation Modeling, Design, and Construction*

■ = strong relationship
▒ = partial relationship

Table III-1-1. Relationships between Near-Term R&D Plans, Partnership Initiatives, and Enabling Research.

Program Title	Priority Strategic Partnerships*												Enabling Res. Areas**						Educ./ Training
	1	2	3	4	5	6	7	8	9	10	11	12	A	B	C	D	E	F	
FHWA (cont'd)																			
Research & Technology Technical Support																			■
Administration																			
National Highway Traffic Safety Administration (NHTSA)																			
Safety Systems	■																■		
Biomechanics															■				
Partnership for a New Generation of Vehicles														■	■			■	
Crash Avoidance--Driver/Vehicle Performance	■												■						
Heavy Vehicles	■												■		■		■		
Fatal accident reporting system (FARS)	■												■						■
National Accident Sampling System (NASS)	■												■						■
Data Analysis	■												■						
State Data Program	■												■						■
Occupant Protection Survey													■						
Special Crash Investigations	■							■	■										
Technology Transfer Programs																			■
Vehicle Research and Test Center																			
Highway Safety Research	■												■					■	■
Administration																			
Federal Rail Administration (FRA)																			
Equipment, Operations & Hazardous Materials Research	■												■		■		■	■	
Track, Structures, and Train Control											■	■			■		■	■	
Safety of High Speed Ground Transportation	■												■		■		■	■	
R&D Facilities																			
Administration																			
Next Generation High-Speed Rail	■															■		■	

**Priority Strategic Partnerships*

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***Enabling Research Areas*

- *A. Human Performance and Behavior*
- *B. Advanced Materials*
- *C. Computer, Information, and Communications Systems*
- *D. Energy and Environment*
- *E. Sensing and Measurement*
- *F. Tools for Transportation Modeling, Design, and Construction*

■ = strong relationship
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Table III-1-1 (cont'd). Relationships between Near-Term R&D Plans, Partnership Initiatives, and Enabling Research.

Program Title	Priority Strategic Partnerships*												Enabling Res. Areas**						Educ./ Training
	1	2	3	4	5	6	7	8	9	10	11	12	A	B	C	D	E	F	
Maritime Administration (MARAD)																			
Industry Competitiveness					■										■				▒
Intermodal Development					■										■			▒	
Maritime Safety	■				▒								■		■				▒
Shipyard Revitalization								■	■								■		
National Security					■										▒				
Administration																			
Federal Transit Administration (FTA)																			
New Bus Vehicles and Infrastructure								■	■			▒		■		■		▒	
Advanced Bus Propulsion Systems								■	■			▒				■			
New Rail Vehicles and Infrastructure	▒					▒						▒				■		▒	
Transit Services Management Innovation						■						▒			■				■
Rural and Specialized Transportation						▒						▒							▒
Metropolitan / Rural Policy Development						▒						▒							
Planning and Project Development							■					■						▒	
Safety and Security	■									■			■						■
Human Resources												▒							■
Transit Cooperative Research Program																			▒
National Transit Institute																			■
University Transportation Centers																			■
Rural Transit Assistance Program	■														■				■
Administration																			
Research and Special Programs Administration (RSPA)																			
Hazardous Materials Research															▒				
Pipeline Safety Research					■								■		▒		■	▒	
Research and Technology											▒	▒							▒
Emergency Transportation															■				

**Priority Strategic Partnerships*

1. *Smart Vehicles and Operators*
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**Enabling Research Areas

A. Human Performance and Behavior
B. Advanced Materials
C. Computer, Information, and Communications Systems
D. Energy and Environment
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■ = strong relationship
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Table III-1-1 (cont'd). Relationships between Near-Term R&D Plans, Partnership Initiatives, and Enabling Research.

Presentation of DOT Near-Term R&D Plans

The Department's near-term plans for its surface transportation research and development are presented in detail in the remainder of this section, which retains the organizational structure used in the third edition of this report. The NSTC Committee on Transportation Research and Development has identified R&D priorities in the following broad elements of the transportation enterprise

- Physical Infrastructure for Transportation
- Information Infrastructure for Transportation
- Next-Generation Transportation Vehicles
- Human Performance in the Transportation System
- Transportation System Assessment Tools and Knowledge

These general categories are used in Section III as a structure for near-term R&D planning. To this structure, the Department has added the following two elements which cut across the above five categories, and enhance the Nation's ability to achieve gains in these areas:

- DOT Investment in University Research, Education, and Cooperative Activities
- DOT R&D Facilities and Administrative Support for R&D

The chapters devoted to these areas provide notation indicating which of the five NSTC categories cover specific programs in these two areas. It should be noted that many of the Department's R&D programs make important contributions to progress in more than one of the above categories. For purposes of this report, each program is presented in the chapter addressing the area to which that program contributes to the greatest relative degree.

For each planned research program, a description is presented with key milestones and budget and staffing data. The table entry "NA" is used to indicate cases in which information was not available at the time of publication. The format used is as follows:

Program Title (Lead Administration)

FY	1997	1998	1999
Funding	in $thousands for each fiscal year		
FTE	in full-time-equiv. for each fiscal year		

Program description, with key milestones for fiscal year 1998.

CHAPTER 2

PHYSICAL INFRASTRUCTURE

Most of us take America's superb transportation physical infrastructure for granted--our roads, railroad tracks, transit systems, airports, railroad terminals, bridges, tunnels, and navigable waterways are unmatched in all the world. However, as stated in the Clinton Administration's technology policy, *Technology for America's Economic Growth, A New Direction to Build Economic Strength*, "…one of the greatest challenges we face is to rehabilitate and maintain the huge stock of infrastructure facilities already in place."

Infrastructure renewal is also a core element of the Department's *Strategic Plan*. DOT is committed to achieving the goal of a coherent and interconnected multimodal National Transportation System. As stated in the plan: "transportation infrastructure strengthens America by bringing people and communities closer together, spurring trade and commerce to meet the new demands of a global economy…Our challenge now is to shift our attention from what we've built to how we can make it work better for our country - through the adaptation and modernization of our existing infrastructure." In response to the Administration's identification of transportation infrastructure renewal as a National priority area, the NSTC Committee on Transportation R&D endorsed the President's four major transportation physical infrastructure strategic R&D goals:

1. *Develop technologies, advanced materials and methods to efficiently maintain and renew the aging transportation infrastructure.*

2. *Improve existing infrastructure performance (Lifecycle cost, environmental impact, service life, traffic capacity, safety).*

3. *Develop and expand technology base for innovative vehicles and systems and for intermodal integration.*

4. *Enable efficient infrastructure emergency response and quick recovery after disasters.*

In addition, the Committee has identified a number of crossmodal and generic R&D priority thrusts. These include:

1. *Nondestructive Test, Inspection and Evaluation, diagnostic sensors, technologies and modeling tools*

2. *High performance materials*

3. *Automation and robotics for renewal engineering*

4. *Emergency response technologies (e.g., seismic damage repair)*

5. *Intermodal hazards reduction (e.g., highway/rail and transit crossings)*

6. *Tools for infrastructure maintenance and prioritization management*

The current US transportation infrastructure includes 3.9 million miles of roads; 575,000 bridges, 180,000 miles of railroad track, 11,000 miles of urban rail, 1,264,000 miles of natural gas pipelines, 26,000 miles of navigable waterways, and airports and seaports. The United States' 3.5 million miles of surfaced roads carry one-third of the ton-miles of domestic freight and nearly 90% of passenger-miles traveled. High-performance airports are central to long-distance public transportation. Public expenditures for construction and maintenance of the highway system alone, derived largely from direct user fees as well as non-user-based tax revenues, are approximately $80 billion per year, requiring a workforce of about 800,000 people.

Obtaining the best life-cycle performance from America's surface transportation infrastructure is thus of great importance not only to users, but also to government at all levels. The Department's 1995 *Status of the Nation's Surface Transportation System: Conditions and Performance Report to Congress* is the latest in a series of biennial reports that track changes in transportation physical and operating characteristics, finance, and usage patterns. The report finds that personal and freight demands on our systems are at an all time high and are expected to increase with population and economic growth, but at a slower rate than in past decades.

Although this *Surface Transportation Research and Development Plan* focuses on surface infrastructure research (highways, transit and rail facilities, pipelines, ports), there are areas in which coordination with aviation infrastructure research will be increasingly important. For example, market shifts toward very large aircraft are making it necessary that runway surfaces be upgraded to endure the forces associated with these heavy planes--even though there are important differences in loading characteristics, coordination between FHWA and FAA on pavement materials research will be important to ensure the widest possible application of improvements in this area.

Near Term Efforts

Emphasis in the area of surface transportation physical infrastructure research is on technologies and procedures associated with: operational efficiency, durability, performance, safety, environmental impacts, renewal and maintenance, real-time nondestructive inspection and monitoring of infrastructure condition and performance; improved design and construction concepts and practices, processes, structures, materials, resource use, and disposal of

construction process wastes, recycling and reuse of byproduct and waste materials, as well as design and construction principles and technologies specifically relevant to intermodal connection points. The surface transportation programs that have physical infrastructure as their major focus are listed below and described in the paragraphs that follow:

Highway Safety (FHWA)

FY[4]	1997	1998	1999
Funding	8,650	9,000	NA[5]
FTE	22.8	22.8	NA

FHWA continues to focus on improving the safety of the highways in the United States. Great advances have been made in the last 20 years but more needs to be accomplished to reduce the more than 40,000 fatalities, 3 million injuries, and $100 billion in economic loss incurred annually due to highway crashes. The FHWA safety research program is directed at improving both the design features of the roadway, and traffic control systems so drivers of all ages can use the highway system in the safest and most productive manner. The research program focuses on driver and pedestrian decision behavior and the highway features such as traffic management, traffic control devices, highway design geometry, signage, markings, and environmental conditions. Current research efforts include:

- Night Visibility Enhancement - Over half of all highway fatalities occur during the hours of darkness. FY 1997 is the first year of a 3-year funded consortium project of private and public participants to address: the impact on highway safety, durability of fluorescent materials, preliminary cost/benefit analysis, feasibility of more efficient UV light sources, health and environmental considerations, installation and maintenance costs, manufacturing and marketing problems, infrastructure issues, implementation strategies, and how the concept can be meaningfully demonstrated.

- Highway Safety Information Management - The highway safety information management program will develop high quality, easily accessible highway safety information systems and provide the technology and analytical tools for the analysis of highway safety problems. The FY 1997 program will provide for the continued improvement and operation of the Highway Safety Information System (HSIS). This effort will include development of supplemental roadway and traffic volume files; full incorporation of advanced technologies such as pen-based computers and GPS receivers; and significant improvements to methodologies for problem identification and safety analysis. The

[4]Throughout Section III, funding levels for each fiscal year are expressed in thousands of dollars, and staffing levels are shown as Full-Time-Equivalents (FTE).

[5]Not available at the time of publication.

program will also include an evaluation of administrative, technological, and analytical improvements to the design and operation of state accident and roadway data systems.

- Interactive Highway Safety Design Model - The objective of the IHSDM program is to develop a series of interactive computer programs that will enable highway designers and design reviewers to assess the potential safety effects of specific geometric design decisions. Vehicle Dynamics, Driver, Accident Analysis, Traffic, and Policy modules are being developed to allow examination of the entire roadway design including the roadway alignment, the roadway cross-section, and the roadside. Full implementation will occur as these modules are integrated into commercially-available computer aided design (CAD) packages. Where appropriate, funds are being leveraged by conducting research in conjunction with the National Cooperative Highway Research Program (NCHRP).

- Roadside Safety Hardware - In 1995, run-off-the-road crashes resulted in 8,000 deaths and estimated societal costs of more than $38 billion. The objective of this research effort is to reduce the severity of run-off-the-road crashes by developing crashworthy roadside safety hardware and other roadside features that can effectively accommodate a diverse vehicle fleet. The research is focused on the development of advanced computer simulation techniques that will reduce the need to rely on crash tests alone and will allow evaluation of safety hardware for a wide range of vehicle types and impact conditions. To insure that the roadside hardware and the vehicles are treated as a "design system", this research program is coordinated closely with NHTSA.

- Pedestrian and Bicyclist Safety - Crashes involving pedestrians and bicyclists account for more than 15% of traffic fatalities. This effort is in support of the Department's National Bicycling and Walking initiative, which aims to safely accommodate increased numbers of pedestrians and cyclists in the highway environment. The goals of the program are (1) to double the current percentage (7.9%) of total trips made by bicycling and walking, and at the same time, (2) to reduce by ten percent the number of bicyclists and pedestrians killed or injured in traffic crashes. This program will develop improved planning techniques, new methods for identifying problem locations, innovative engineering countermeasures, and training tools to guide users in the implementation of improved pedestrian and bicycle facilities.

- Human Factors Research for Highway Safety and Intelligent Transportation Systems - The goal of this program is to increase highway safety by improving the compatibility between drivers (including commercial vehicle operations), basic highway design functions, traffic control devices, and smart technologies to enhance highway safety, traffic control centers and traffic flow. The primary current research areas include: updating the Older Driver Handbook; investigating driver response to traffic control devices and other safety countermeasures; and evaluating the influence of highway design on driving behavior.

- Engineering Improvements for Enhanced Safety and Operations - Growth in traffic and congestion is causing a shift from arterials onto local roads, where speed and conflicts with nonmotorists are major concerns. The aim of this research is to identify, develop, and test engineering measures to safely and effectively manage speed, increased traffic, driver decisions, traffic control, and nonmotorists consistent with the function and use of different road facilities.

Major milestones for fiscal year 1998 will include:

- Beta testing of selected IHSDM modules through cooperative agreements with State DOTs and/or design consultants.

- Standardized software for analyzing crash test data and preparing test reports. This software will help to promote international harmonization of testing standards.

- Completion of a study assessing bicycle safety countermeasures.

- Simulation and field study evaluation of the effects of geometry and environmental factors on drivers' selections of headway, in order to identify those countermeasures that are the most effective in helping drivers to maintain proper headway.

- Enhancement of network traffic simulation models to evaluate the effect on delay and conflicts of innovative intersection designs such as jug handles and continuous flow intersections, for a range of traffic conditions.

Pavement Research Program (FHWA)

FY	1997	1998	1999
Funding	13,731	11,150	NA
FTE	24	24	NA

The goal of the FHWA Pavements Research Program is to develop more cost-effective and better-performing pavements. The development of these technologies is an evolving process which includes three stages of utilization: current practices, best practices, and state-of-the-art practices.

Although there are significant differences in the typical loading profiles (e.g., longitudinal motion of multi-axle line-haul trucks compared to rapid vertical motion of much heavier aircraft), FHWA works closely with FAA on the improvement of pavements. FAA is currently seeking partners to share the cost of building a pavement test facility that would enable testing of new pavements, and the identification of the best possible replacements at

airports where heavier new transport and cargo aircraft pose a particular problem for runway deterioration.

FHWA's Pavement Research Program is currently divided into three major focus areas:

- Pavement Management - Continuing efforts are being made to implement protocols or pavement condition data collection and analysis, and to develop nondestructive pavement evaluation technology.

- Quality Improvements - Continuing efforts are being made to validate the Superpave mixture design and analysis systems; to develop performance-related specifications; to develop guidelines for crumb rubber modified (CRM) asphalt pavement design and construction; to investigate alkali-silica reaction (ASR) potential in existing Portland cement concrete (PCC); to develop the use of high performance concrete in pavement applications; and to support Superpave performance models management, WesTrack, and the AASHTO Materials Reference Laboratory (AMRL).

- Long-Term Pavement Performance - The largest pavement performance research project ever undertaken, the 20-year LTPP research encompasses 2,600 in-service pavement test sections, and includes two sets of experiments: the General Pavement Studies (GPS) and the Specific Pavement Studies (SPS). The LTPP data base will serve as a critical resource for pavement performance research and will yield improved pavement performance model and design procedures.

Major FHWA pavement research milestones planned for fiscal year 1998 will include:

- LTPP data analysis will yield 8 to 10 specific pavement quality enhancements.

- Results from the tire footprint pressure study.

- Guidelines for CRM asphalt pavement design and construction.

- Modeling of load transfer in PCC pavements.

- Pavement performance models for new pavement designs.

Structures Research Program (FHWA)

FY	1997	1998	1999
Funding	14,362	15,256	NA
FTE	15	15	NA

FHWA's Structures Research Program strives to obtain (1) measurable improvement in the life cycle costs of US highway structures built after 2005 and (2) observable inspection and maintenance cost savings or extensions of services life in all common types of existing structures without degradation of highway safety or the environment.

Specific current objectives include:

- Research on the physical and chemical characteristics of new high-performance materials so as to develop definitive criteria and guidelines for their use in the repair, rehabilitation, and construction of bridges.

- Improvements to the reliability, speed, and user-friendliness of nondestructive evaluation (NDE) methods for quality control during construction; improvements to the ability to detect hazardous conditions during bridge inspections; development of reliable, fast, and efficient global NDE for bridge monitoring; and development of new technologies and techniques for integrating quantitative NDE into bridge management systems.

- Finding better means for assessing the vulnerability of bridges to seismic and other natural forces; developing improved guidelines and design criteria for the design and construction of bridges to resist these forces; and developing improved methods of retrofitting existing structures against natural hazards.

- Conducting higher-risk exploratory research to investigate new techniques for nondestructive characterization of materials.

Major FY 1998 milestones will include:

- Durability testing, design criteria guides, and surface-preparation guides for interfacial adhesive behavior of structural adhesives.

- Completed construction of FHWA’s facility (i.e., a bridge) with known signatures that can be used to test, evaluate, and calibrate NDE equipment.

- Technical guidance for determining the response and design of miscellaneous highway structures under wind load and vibration.

- Study of new techniques for measuring fatigue in aging steel, for acoustic microcrack detection, and for measurement of steel corrosion in reinforced concrete.

- Construction of at least 50 bridges utilizing high-performance materials.

Environmental Research (FHWA)

FY	1997	1998	1999
Funding	5,443	5,566	NA
FTE	5.0	5.0	NA

FHWA's Environmental Research Program addresses highway impacts on air quality, wetlands, water quality, hazardous waste sites, communities, aesthetics, and noise. The goals of the environmental research program include: better capability to understand and predict the impacts of highway transportation systems on the natural environment, cultural resources, and the local community; development of methods to avoid and mitigate those impacts and enhance the environment; the integration of environmental considerations into the system planning and project development processes in a cost effective manner; and share innovations with FHWA partners in State and local governments. The major current research areas include:

- Air Quality - Assisting States and Metropolitan Planning Organizations (MPOs) with meeting Clean Air Act requirements by providing improved analysis methodologies, and information on the relationship of transportation programs and emissions on air quality levels.[6] Assisting EPA in its efforts to develop a new and more accurate mobile source emissions model.[7] Examining the impacts on the transportation program, and the additional control strategies that are necessary, resulting from new and tighter National Ambient Air quality Standards for ozone and fine particulate matter.

- Wetland Resources - Developing methods to delineate, identify, restore, and protect existing wetlands, and identifying innovative wetlands restoration and creation projects around the nation.

- Water Resources - Updating research on highway storm water runoff to account for new highway construction techniques, new motor fuel constituents (e.g., MTBE), changes in engine emissions, and new vehicle components.

- Environmental Process - Providing training and technical assistance to facilitate effective implementation of the FHWA National Environmental Policy Act (NEPA) process.

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[6]Discussed further in Chapter 6, under the description of FHWA's Transportation Planning Research.

[7]Discussed further in Chapter 6, under the description of FHWA's Transportation Planning Research.

- Community Impacts and Public Involvement - Evaluating policy, procedural, technical, and legal issues associated with community impact assessment and mitigation options and evaluating data needs, assessment techniques, and methodologies to allow for the efficient determination of community dynamics and impacts of proposed transportation projects.

- Historic and Archeological Preservation and Aesthetics - Providing tools necessary to meet technical and procedural requirements related to the preservation of historic and archeological resources, identifying highway maintenance practices which can benefit visual quality such as the use of wildflowers and other native plant species.

- Highway Traffic Noise - Developing technology transfer resources that address advancements in construction noise measurement, analysis, and abatement.

Major fiscal year 1998 milestones will include

- Documentation and evaluation of the effectiveness of transportation programs that are initiated to meet mobile source emissions budgets.

- Completion of a Mitigation Manual for Estuarine Wetlands.

- Publication of an evaluation of ultra-urban best management practices for controlling storm water runoff from highways.

- Consideration of the impacts of current technology such as ITS on the social, environmental, and economic impacts of a transportation project.

- Identification of state-of-the-art predictive methodology for dynamic social characteristics/factors.

- Publication of design standards for the rehabilitation and preservation of historic highway bridges.

- Development of a videotape which addresses noise-compatible land use planning.

Right-of-Way Research Program (FHWA)

FY	1997	1998	1999
Funding	322	365	NA
FTE	0.25	0.25	NA

FHWA's Right-of-Way (ROW) Research Program enhances State and local government highway agency capabilities in right-of-way program management, technical development and

information sharing. This research effort includes studies that identify and advance right-of-way management methodology; right-of-way technical innovation; and harmonious land use applications.

New research efforts in FY 1997 will include video imaging to enhance understanding and presentations of highway impacts for property owners and in condemnation cases, and additional assessments of right-of way impacts of Federal programs and policies.

FY 1998 milestones include:

- Dissemination of possible "benchmarks" to improve the quality of ROW program management.

- Deployment of interactive video imaging tools for key right-of-way related functions.

Technology Assessment and Deployment (FHWA)

FY	1997	1998	1999
Funding	13,811	14,800	NA
FTE	27	27	NA

The purpose of FHWA's Technology Assessment and Deployment program is to identify and assess innovative research results, technology, and products and to promote the application of those that are determined to be of potential benefit to the highway community. Key areas of interest currently include:

- Roadway Applications - Development of innovative solutions to keep pace with asphalt and concrete pavement rehabilitation.

- Structures and Soils - Application to structural components (e.g., bridges, retaining walls, tunnels, structural signposts) of innovative technology, including high-performance structural materials, modern rational design codes, nondestructive evaluation systems, seismic retrofit techniques, ground improvement methods, and scour protection systems.

- Safety and Design - Safety outreach, hardware, and programs; and motor carrier safety. Examples include a red light running campaign, countermeasures for older road users, and automated brake testing technology for commercial vehicles.

- Traffic and Motor Carrier - Implementation of new and emerging technology in traffic management, simulation, and demand management, and to facilitate the safe and efficient movement of goods by the motor carrier industry.

- Technology Marketing - Technology transfer through workshops and demonstrations on breakthrough technologies, international technology scanning, cooperative research, and participation in international organizations.

- Technology Operations - Use of advanced media (e.g., Internet, online systems, intranet, CD-ROM, CD-Interactive, multimedia, etc.) to improve the ability to reach users throughout the highway community.

FY 1998 milestones will include:

- Initiation of a demonstration project to assist highway officials in using life-cycle cost analysis (LCCA). This activity will outline the process, identify key data and assumptions, and provide hands-on training on how to perform LCCA.

- Completion of the development, beta testing, and implementation of a comprehensive computer program for designing bridges for extreme events such as ship impacts and earthquakes.

- Incorporation of the Commercial Vehicle Information Systems pilot technology into the Advanced Law Enforcement Response Technology vehicle.

- Demonstration and promotion of leading-edge corridor management technology for freeway and urban arterial traffic control.

- A videotape and multimedia course which shares techniques for the cost-effective use of heat straightening for the repair of damaged bridges.

Local Technical Assistance Program (FHWA)[8]

FY	1997	1998	1999
Funding	8,827	12,000	NA
FTE	2	2	NA

The FHWA's Local Technical Assistance Program (LTAP) improves access to highway technology for local communities. The LTAP, with its 57 LTAP technology transfer centers—one in each state, one in Puerto Rico, and six to serve American Indian tribal governments—serves as the primary channel through which innovative transportation technology and training are delivered to both urban and rural communities. Training is provided in a number of ways: workshops at various locations throughout a State; circuit-rider

[8]A portion of the funding for the LTAP is through Section 6004 of ISTEA.

visits to local transportation agencies for on-site tutorials or hands-on training; field demonstrations; and lending of training materials (e.g., videotapes, manuals, workbooks).

Key FY 1998 products and milestones include:

- A traffic safety assessment course and field guide for local officials.
- A videotape and pocket field guide on fundamental field testing procedures necessary for basic maintenance and design of gravel roads.
- CD-ROM publication of all LTAP reference information, newsletters, and special reports.

Technical Training (FHWA)
National Highway Institute

FY	1997	1998	1999
Funding	4,269	8,000	NA
FTE	13	13	NA

The National Highway Institute (NHI) has a legislative mandate to provide education and training to Federal, State and local transportation agencies in a proactive effort to apply state-of the art transportation technologies emanating from FHWA R&D programs. As such, it is the leading resource within FHWA for providing high quality comprehensive education and training programs tailored to meet the needs of transportation professionals at all levels of the Federal, State and local government as well as U.S. industry. In addition, the NHI is structured to share this information with the international transportation community. The NHI envisions the utilization of both traditional and modern instructional techniques to provide high quality education and training in transportation technology that customers will find to be affordable, convenient and timely.

Domestically, the customer base of the NHI is changing, and the number of students is expected to grow by 25 percent in FY 1998. State DOTs are downsizing, and much of their construction, maintenance and operations are being shifted to contractors who are already beginning to seek NHI training. The remaining State DOT engineers now have to be knowledgeable in a range of subjects so they need a wider variety of NHI courses each year. The number of NHI customers from industry has grown from five percent to 11 percent in four years and is expected to climb to 15 percent in FY 1998.

Internationally, the NHI offers specialized courses to foreign professionals in areas such as technology transfer techniques, advanced pavements technology, and international bridge inspection. The NHI markets its courses in some 30 countries and teaches a few international courses in the United States so that foreign professionals can link up with members of the U.S. transportation industry.

The NHI is meeting these challenges by improving its procurement procedures and modernizing its instructional techniques. In addition to conventional classroom training, NHI deploys or plans to deploy a variety of instructional technologies such as CD-ROM, electronic performance support systems, interactive computer, and virtual reality simulations; and a host of course delivery techniques such as just-in-time training, networked delivery of instruction, satellite broadcast, teleconferencing, and audio and video. These technologies and techniques are optimally adapted to the audience.

The NHI is active in several other areas related to education and training. The NHI operates a College Curriculum Program that makes its training manuals and materials available to university professors for use in updating their courses. The NHI conducts conferences, congresses, distinguished lecture series, seminars, symposia, and workshops; exhibits its services at World Trade Fairs; provides technical assistance to its international customers; administers an international personnel exchange program for FHWA offices; receives over 100 international visitors per year; manages the AASHTO/FHWA personnel exchange program; provides oversight to the FHWA university transportation centers and institutes programs; and grants fellowships to students and faculty members who are pursuing or plan to pursue careers in transportation.

Current activities include:

- Delivering over 500 course presentations on over 120 transportation topics to more than 16,000 participants.

- Conduct presentations that promote intermodal transportation, stimulate understanding of the cross-cutting issues, and foster seamless interaction among the various transportation modes.

- Providing a program of at least 12 courses addressing pavements and materials issues, including Superpave, to train State and local transportation agency staffs. Pavements and materials represent the largest share of capital investment by public agencies.

- Delivering a series of courses on structural foundations. These courses will aid transportation officials in averting bridge failures from natural disasters such as floods or earthquakes.

- Introducing a formal program of NHI courses for the private sector, including transportation companies, contractors, consultants, firms, and materials suppliers. This program is expected to become self-supporting in three years.

Key milestones for fiscal year 1998 will include:

- Delivering over 600 course presentations on over 125 transportation topics to more than 20,000 participants.

- Augmenting classroom training for the 4,000 additional students who will be taking NHI courses in FY 1998 with Distance Learning, "Just in Time" Training, and Interactive Computer Training.

- Develop three more computer-based training courses, similar to the one last year on transportation safety, that will utilize the modern technique of "Just-in-Time" training to provide instruction to workers on the job.

- Develop and present a new course on seismic retrofitting of transportation bridges. The course will be based on technology identified in FHWA research.

Implementation of the Strategic Highway Research Program (FHWA)

FY	1997	1998	1999
Funding	20,000	0	NA
FTE	16	NA	NA

A six-year program of product implementation and continuation of the Long-Term Pavement Performance program related to the Strategic Highway Research Program (SHRP) was authorized under ISTEA. The benefits of the SHRP are being realized through its systematic implementation. Products of the research program are being developed under the guidance of technical working groups, which include FHWA field organizations, industry associations, the Transportation Research Board, and users. Their work includes the following:

- Prepare and conduct showcase packages of technology modules for demonstration and delivery to the states via FHWA regional offices and through workshops for state planners and industry.

- Operate a Technology Delivery Team to address Superpave with representation from the research and development, technology applications, and program offices within FHWA.

Key products and milestones for FY 1998 include:

- Continue implementation of SHRP products for local governments.

- Complete development and field trial of improved prototype Performance Related Specifications for concrete pavement.

- Initiate studies to evaluate the Superpave mixture tests and performance models for rutting, fatigue cracking, and low temperature cracking.

- LTPP verification sections designed and constructed and field assistance provided for Superpave technology.

- Continue demonstrations of the latest test procedures and equipment using the concrete mobile laboratory.

- Design, construct, and evaluate projects using criteria established for high performance concrete pavements.

- Develop interim specifications for Performance Related Specifications for Portland cement concrete and hot-mix asphalt pavements and begin validation of performance models established for use in PRS for concrete paving.

- Complete interim development and assessment of the SHRP binder direction tension test.

- Demonstrate high performance concrete procedures, materials, and equipment to improve the durability and performance of concrete; this will follow up on SHRP concrete durability findings and address additional performance, environmental, and quality issues.

- Accelerate development of performance related specifications for asphalt and concrete pavements. Findings from the WesTrack full-scale accelerated loading test track of the effects of construction and materials variability on asphalt pavement performance will be analyzed to develop pay factor adjustments and to identify construction and materials quality control parameters.

- Work with the State DOTs to adopt the Superpave binder specification by 1997 and adopt the volumetric mix design specifications by 2000 through five Superpave Regional Centers, a pooled-fund equipment purchase for States, a full program of training through the National Asphalt Training Center, and technical assistance.

- Refine concrete and structures technologies and through such means as showcase workshops, introducing them to State DOTs and contractors.

- Ensure that all applicable SHRP products are now provisional AASHTO standards for use by the States and industry.

- Provide information on the products and the schedule for implementation activities through FHWA's SHRP Information Clearinghouse.

- Continue to work internationally to promote cooperation in the use of SHRP technology, including cooperative efforts with Canada, Latin and South America, the European Community, and Japan.

Technology Implementation Partnership Program (FHWA)

FY	1997	1998	1999
Funding	0	11,000	NA
FTE	0	NA	NA

The great value of close partnerships between Department modal administrations and State, local, private, academic, and other entities was proven by ISTEA's implementation of the Strategic Highway Research Program (SHRP) products. It is essential that the Department continue its strong partnership role with State DOTs, the Transportation Research Board, and industry to move technology and innovation into common practice. The Technology Implementation Partnership Program would foster such alliances that support efforts in high-payoff areas.

The Technology Implementation Partnership Program's predecessor, SHRP, received $108 million as part of the ISTEA legislation. SHRP successfully promoted transportation-community partnerships, with most of the program's implementation efforts directed toward sharing technology with the States and industry, supporting the test and evaluation of products, and associated training and communications activities. This approach has been very successful in terms of the number of individuals who have been introduced to the technology, the extensive product trials, and adoption of the products by the States and industry. The "SHRP Lead States Program," which has recently been initiated by the AASHTO SHRP Implementation Task Force, is an excellent example of the effectiveness of partnerships among Department modal administrations, the State DOTs, and industry.

Expected FY 1998 products and milestones include further development and implementation support in high-payoff areas, such as the Superpave system. FHWA is working with States, academia, and industry to establish a complete program that is well validated, implements performance prediction algorithms, and is universally adopted. The Technology Partnerships Program, too, would support other key alliances.

- Initiation of regional technology excellence centers.
- Initiation of user-producer groups.
- Increased LTPP product implementation.
- Increased technology access/exchange programs.
- Improve information-dissemination networks to reach beyond States to cities, counties, and other localities.

Long-Term Pavement Performance (FHWA)

FY	1997	1998	1999
Funding	6,000	15,000	NA
FTE	0	NA	NA

The Long-Term Pavement Performance (LTPP) program is a 20-year project initiated under the Strategic Highway Research Program (SHRP). The goal of the LTPP program is to extend the life of highway pavements through achievement of the following:

- Evaluate existing design methods.
- Develop improved pavement design methodologies and strategies for the rehabilitation of existing pavements.
- Develop improved design equations for new and reconstructed pavements.
- Determine the effects of loading, environment, materials properties and variability, construction quality, and maintenance levels on pavement distress performance.
- Determine the effects of loading, environment, material properties and variability,
- Establish a national long-term pavement data base to support SHRP objectives and future needs.

LTPP is the largest pavement performance research project ever undertaken. It involves periodic data collection and condition monitoring of approximately 2,200 in service pavement test sections, located throughout the United States and Canada, over a 20-year period. The LTPP research includes two sets of experiments: the General Pavement Studies (GPS) and the Specific Pavement Studies (SPS). The GPS experiments focus on existing pavements and the designs most commonly used in the United States and Canada. Individual test sections offer a wide range of values for key study variables and selected covariates. The SPS experiments involve test sections constructed specifically for the LTPP research and focus on the efficacy of specific pavement design factors involved in new pavement construction, the application of maintenance treatments to existing pavements, and pavement rehabilitation.

Major activities and accomplishments for FY 1997 include:

- Handbook(s) for the design and construction of long-lived Portland Cement Concrete (PCC) pavements were developed including: (1) guidelines for the selection of k values on the basis of soil type and site conditions or backcalculation; (2) validation of the NCHRP 1-30 performance model for rigid pavements; (3) quantitative estimates of the effects of key design features and practices on PCC

pavement performance; and (4) improved performance prediction models for PCC pavements.

- A validated temperature prediction procedure for asphaltic concrete (AC) pavements; temperature adjustment procedures for backcalculated moduli, deflections, and basin characteristics; draft standard for temperature prediction and correction in the structural evaluation of AC pavements was developed.

- A new hot-mix asphalt (HMA) pavement design handbook providing guidance on: (1) use of backcalculated and laboratory moduli in pavement design; (2) estimation of moduli from other materials data; (3) consideration of drainage conditions in pavement design; (4) characterization of the subgrade, including seasonal variations; and (5) estimation of AASHTO layer coefficients in light of seasonal variations in layer moduli was published.

Expected FY 1998 milestones include:

- "Master Analysis" of all LTPP data to develop improved pavement design methodologies and strategies for the rehabilitation of existing pavements for new and reconstructed pavements and to determine the effects of loading, environment, material properties and variability, and construction quality on pavement distress and performance.

- Completion of all laboratory materials testing of SPS and GPS test samples.

- Completion of construction of all SPS projects.

Advanced Research (FHWA)

FY	1997	1998	1999
Funding	0	10,000	NA
FTE	0	NA	NA

The advanced research concept exists in response to the observed need to have research and development units dedicated to the investigation of new, emerging or advance technologies which have potential, for long range application in highway engineering R&D and in safety and traffic operations R&D. This is to ensure that there is a central focus and continual surveillance of emerging and advanced technologies. The main activity areas for the advanced research program reflect the current and future needs of research and development and are:

- Diagnostic methods

- Materials characterization

- Modeling and simulation technologies
- Artificial intelligence and mathematics
- Advanced sensor and communications technologies

Expected FY 1998 products and milestones include:

- Preliminary guidelines for diagnosis of ettringite-related distress.
- Full scale installation of Bragg grating fiber optics monitoring system on one or more highway bridges.
- Completion of digital waveform-based acoustic emissions measurement
- Field evaluation of portable neutron/gamma spectroscopy system for detection of chlorides in Portland cement concrete.
- Completion of testing of the effect of fatigue on the fundamental properties of aging steel.
- Preliminary model identified for drowsy driver warning system.
- Initiation of at least one formal study applying multi-criteria optimization methods. Two possible topics are optimum intersection light timing or optimum safety project selection over a network.
- A breadboard tool will be completed combining object oriented approaches with graphical user interface to allow rapid prototyping and analysis with visual presentations. This tool (the Equation Shell) will be of use to researchers for analysis of data, the incorporation of research findings in the development of new products, and as an technology transfer mechanism.
- Vehicle magnetic signature database: This database will update vehicle magnetic signatures which were last measured during the early 1970's.
- Smart loop detector field test and evaluation: This effort will determine smart loop detector performance specifications and develop functional specifications for detector communications to the traffic controller.

Applied Research and Technology Program (FHWA)

FY	1997	1998	1999
Funding	41,000	0	NA
FTE[9]	NA	NA	NA

ISTEA Section 6005 laid out the Applied Research and Technology (ART) Program with the goal to accelerate the testing, evaluation, and implementation of technologies to improve the durability, efficiency, environmental impact, productivity, and safety of highway, transit, and intermodal transportation systems. The legislation had several requirements and special provisions:

- It required the development of Guidelines for the selection of technologies to be tested.
- It broadly described the types of technologies to be tested.
- It designated specific technologies that were to be tested.
- It required the projects to be carried out on the "Federal-aid systems" with the Federal share not exceeding 80 percent.
- It provided for technical assistance to the States and for an annual report to Congress.
- It provided funding of $35.0 million for fiscal year 1992 and $41.0 million for each of the fiscal years 1993-1997 for the overall program and provided funding of not less than $4.0 million per fiscal year for heated bridge technologies, not less than $2.5 million per fiscal year for thin bonded overlays, and not less than $2.0 million per fiscal year for all weather markings.

To implement the provisions of the legislation, FHWA, through the Research and Technology Executive Board, developed a program composed of three elements: Priority Technologies, Test and Evaluation through the Highway Innovative Technology Evaluation Center (HITEC), and Applied Research. The programs are jointly administered by the Associate Administrators for Safety and System Applications and Research and Development with funds assigned to a variety of headquarters offices carrying out the program.

Priority Technologies involve the implementation and evaluation of technologies specified in the legislation and other priority technologies that have been identified by FHWA and proposed for partnerships through general solicitation. Test and Evaluation Through HITEC involves full-scale testing of new technologies of projects originating in both the public and private sector coming through HITEC. The use of HITEC was incorporated into the

[9]The FTE to administer this program are located in various research and technology offices throughout FHWA.

Guidelines that FHWA developed. Applied Research projects support the development of R&D products, the implementation of new technologies and support for International activities and the Advanced Research Program.

Key products and milestones for FY 1998 will include:

- Continue the Priority Technology Program through which projects identified by FHWA fields offices to accelerate the testing, evaluation, and implementation of new and underutilized technologies that will benefit the intermodal transportation system by improving the durability, efficiency, environmental impact, productivity, and safety. The program operates through cost-sharing partnerships between the public and private sectors.

- Complete or continue evaluations of thin bonded overlay projects at sites around the country.

- Complete or continue evaluations of heated bridge deck projects at sites around the country.

National Technology Deployment Initiatives (FHWA)

FY	1997	1998	1999
Funding	0	56,000	NA
FTE[10]	0	NA	NA

The National Technology Deployment Initiatives (NTDI) will build upon the success of the Applied Research and Technology Program (ISTEA Section 6005), which focused on the application of new and innovative technologies. The NTDI will focus on accelerating the implementation of technologies that will address a set of specific "customer driven" technology goals, such as improving safety of nighttime driving, driving in wet weather, and other periods of limited visibility; reducing the delays and accidents resulting from construction and maintenance work; improving quality and durability of construction materials; extending the life of the current infrastructure; and incorporating technologies in all phases of construction and operations that support and enhance the environment. This program will have two major components to support the achievement of these goals: authorized funding and program incentives.

The National Technology Deployment Initiatives (NTDI) program is designed to greatly expand the application of innovative technologies to directly benefit transportation system users through reduced delays, extended life of the transportation infrastructure, improved system reliability, improved safety, enhanced environmental features, and support for sustainable

[10]The FTE to administer this program are located in various research and technology offices throughout FHWA.

growth. These goal areas directly respond to input received by the Department as part of reauthorization outreach efforts, in addition to priority concerns of customers, as identified by the 1996 National Highway User Survey commissioned by the National Quality Initiative (NQI) Steering Committee.

This proposed program would be designed to deliver resources to a focused set of program areas that will result in significant, tangible benefits to transportation users. A major theme is to foster actual deployment of projects so that users will quickly benefit from applications of innovative technologies, leading to greater acceptance and willingness by States and others to use alternative funding sources for such projects.

Proposed goal areas directly address areas that are very high priorities of our customers, as indicated by the recent survey conducted for the NQI Steering Committee. Characteristics of the program follow:

Customer-Driven—The program objectives, delivery mechanisms, and schedule would target innovative technologies that have tremendous potential to result in direct, tangible benefits to customers. The involvement of public and private area stakeholders will be important to the program design and widespread dissemination of lessons learned, quantifiable results, and products developed.

Deployment-Focused—This program would also be designed to "get projects on the ground" in order to show results from application of the technologies and deliver expected user benefits. Emphasis will be on supporting States and other implementers with funding and technical assistance in the deployment of innovative technologies. Where needed to directly support the deployment goals, program funding will also support highly focused research, test, evaluation, training, and demonstration efforts.

Innovative Delivery Mechanisms—The program would use both innovative and traditional mechanisms. Potential features include authorized funding for participation by States and other implementation agencies, program incentives, regulatory flexibility, and cooperative projects. Resource and risk pooling in concert with key public and private technology partners is also envisioned.

Multimodal Support—The technology goal areas address universal themes such as extended infrastructure life, use of better performing materials, transportation network efficiency, and environmental enhancement. Applications of these technologies will benefit roadway, transit, and railway systems.

Through this program, the Department, along with key technology partners, would potentially address six specific goal areas:

- Reduce delay and improve safety within construction and maintenance work areas.
- Extend the life of the current infrastructure.
- Increase system durability and life with high performance materials.
- Support and enhance the environment with use of innovative technologies.
- Increase use of alternative modes to improve community-level transportation service.
- Minimize snow and ice impacts to the transportation system.

The NTDI program must remain responsive to the very dynamic nature of technological development and progress within transportation agencies. These advances may originate within the transportation community, or from other areas such as materials science, human factors, and structural design/construction engineering. In addition, the priorities of users and capabilities of delivery organizations do change over time. For these reasons, the Department would be encouraged to develop and maintain close working relationships with other public and private sector entities, and be authorized to add new goal areas and refine existing areas as needed.

The NTDI program would be managed by the Department as a major element of the overall Research and Technology Program. All of the R&T program elements are designed to be complementary, with the NTDI program providing the key resource to help "close the gap" between current construction, maintenance, and operation practices, and greatly expanded adoption of innovative technologies. It is expected that the FHWA will be the lead agency for this program, in cooperation with other Department modal administrations, including the Federal Transit Administration, the Federal Railroad Administration, the National Highway Traffic Safety Administration, and the Research and Special Programs Administration. Key program operation/management features would include:

Program Evaluation/Assessment of Opportunities—To the extent possible, program goals will be quantifiable, and continuing evaluation will be used to define need for redirection. New technologies that may support the goals should be identified, evaluated, and applied expeditiously.

Partners/Stakeholders—Regular interaction with key stakeholders regarding program delivery mechanisms, refinement of goal statements, cooperative efforts, and other matters is essential. These stakeholders include public sector entities such as State DOTs, local

governments, and local transit authorities; private sector companies; industry associations; and academia.

Information Sharing—The overall goal of increasing adoption of innovative technology requires that decisionmakers at the State and local levels have quick and efficient access to reliable, up-to-date information. This is expected to be an important focus of the NTDI program's management system.

Technology adoption by public agencies and private companies entails a fair degree of risk. Public agencies, in particular, have been reluctant to adopt innovations that have not been proven to be effective or that do not appear to have continuing, long-term support. Reliable, consistent funding would be a necessary feature of the NTDI program.

Seismic Research Program (FHWA)

FY	1997	1998	1999
Funding	2,000	0	NA
FTE	2	0	NA

This FHWA research program for the seismic protection of bridges studies the seismic vulnerability of highways, and bridges on the Federal-aid system and works to develop and implement cost-effective methods of retrofitting such systems to improve their seismic performance. Remaining efforts in FY 1997 include:

- Complete evaluation of approaches for portraying the National hazard exposure to the highway system.
- Complete development of design time history ground motion.
- Complete seismic retrofit of shear-critical bridge columns with final report.
- Complete development of training course for seismic retrofitting for bridges.
- Complete study of "Effect of Spatial Variation of Ground Motion on Highway Structures."
- Complete Liquefaction Remediation Techniques for Bridge Foundations.

Timber Bridge Research Program (FHWA)

FY	1997	1998	1999
Funding	1,000	0	NA
FTE	1	0	NA

FHWA's Timber Bridge Research Program focuses on developing new timber bridge systems, and/or improving present systems which permit the efficient use of primary commercial wood species and previously under utilized species for transportation use. Remaining activities in FY 1997 include:

- Standard plans for several timber bridge types.
- Computer design aids, and interactive designs.
- New NCHRP 350, Test Level 3 bridge rails.
- Refined design criteria to update AASHTO codes.
- Find alternative stressing systems for post-tensioning stressed deck bridges.

Research & Technology Technical Support (FHWA)

FY	1997	1998	1999
Funding	0	10,000	NA
FTE[11]	0	NA	NA

Responsibility for transportation research in the U.S. is highly decentralized. States, universities, private entities, as well as the Department of Transportation all play important roles in defining the research agenda, and in conducting the actual research. FHWA research and technology technical support ranges from sponsorship of the Transportation Research Board (TRB) and AASHTO; to funding for the Small Business Innovation Research (SBIR) program; to data processing and editorial support for the Turner-Fairbank Highway Research Center (TFHRC); to quarterly publication of *Public Roads*, which features developments in FHWA's policies, programs, and research and technology.

[11]The FTE to administer these activities are located at various offices within FHWA.

Track, Structures, and Train Control (FRA)

FY	1997	1998	1999
Funding	7,346	7,746	NA
FTE	3	NA	NA

The goal of FRA's Track, Structures and Train Control research program is to improve the safety and reliability of the Nation's railroad tracks by participating with industry in efforts to address track geometry and material, signal defects, and other train control systems. Track defects are one of the leading cause of train accidents, and the damage associated with those accidents totals on the order of $50 million annually. The program will work to develop technology to discover such track defects before failure; develop methodologies for predicting service life of track and signal components and how they behave under dynamic conditions; develop protocols to improve efficiency in inspection, preventive maintenance, repair, and renewal actions; and develop technology to enable safe train operation in a heavy tonnage environment. Research will increase emphasis on the testing, analysis, and evaluation of safety-critical track, grade crossing, signal system components, inspection devices, and vehicle response to track irregularities. Current research efforts include:

- Track and Components - Quantifying the resistance of concrete-tie tracks to lateral buckling from heat and load stress; measuring track impacts of heavy vehicles with improved suspensions; assessing performance of improved steel material for select track components.

- Inspection and Detection - Improving and automating track geometry measurement for derailment risk assessment; assessing the feasibility of rail flaw detection through horizontal shear electromagnetic acoustic induction.

- Track/Train Interaction - Developing algorithms for the real-time assessment of the safe limits of track geometry; identifying the correlation between track geometry/stiffness and wheel/rail forces; developing computer models for simulating the dynamic interaction between vehicle and track.

- Signals, Train Control, Communications, and Electrification - Assessing the reliability of new technologies embedded into existing signal systems; improving methods for detecting train presence on track and grade crossing approaches; developing means for assuring safety of electrified railroad operations in new corridors.

Key milestones for FY 1998 will include:

- Improved track inspection protocols based on an improved understanding of crack growth rate for newly-discovered rail flaw type initiated by stress and heavy wear deformation.

- Novel methods or standards for rating the safety of track condition using newly-integrated track and vehicle models.

- Improved means for integrating train presence sensors and train control systems.

- Assessment of the safety impacts of data transmission “backbones” for sensor and control elements of intelligent train systems.

Next Generation High-Speed Rail Facilities Improvements (FRA)

As part the Next Generation High-Speed Rail Program, discussed below in Chapter 4, FRA will be providing funding to the State of Oregon to upgrade tracks, control systems, and terminals on the Portland-Eugene Corridor. Included in the project will be an examination of new techniques for the construction and maintenance of track for high-speed passenger operations.

Intermodal Development (MARAD)

FY	1997	1998	1999
Funding	0	0	NA
FTE	NA	NA	NA

The goals of the Maritime Administration's Intermodal Development program are to assess and deploy innovative technology and management practices for all components of the transportation system infrastructure to improve system capability, efficiency, productivity, safety, environmental sensitivity, and military utility. In addition to SBIR agreements discussed in Chapter 7, there are four research programs under Intermodal Development:

1. Intermodal Transportation Research Program -- This program works to improve the efficiency of all aspects of the flow of cargo and data from origin to destination in U.S. domestic and international trade through the introduction of advanced technologies and operating systems designed to enhance productivity, reduce costs, and increase service quality. MARAD assists U.S. ocean carriers, inland waterway operators, stevedores, terminal operators, ports, and others involved in intermodal transportation through National multi-modal studies and joint MARAD/industry cost-shared research and development. MARAD provides for coordination of intermodal studies with the Department’s Office of Intermodalism and other modal administrations, as well as other Federal, state, and local agencies.

2. Cargo Handling Cooperative Research Program -- This cost-shared program is carried out under a cooperative agreement between MARAD and industry members to improve the cargo handling productivity of American carriers. The research activities are jointly selected by the participants.

3. Commercial-Military Transportation Research Program -- This program focuses on the identification and development of marine intermodal transportation technology which can be used to meet military and commercial requirements.

4. Port Development Planning Research Program -- The Maritime Administration's Port Development Research Program goal is to determine port requirements for U.S. ports in order to improve transportation system capability, efficiency, productivity, and safety. The program also ensures that ports are able to operate with efficiency and minimal disruption during times of National emergency. Related near-term activities include:

- Complete the study and workshop on the impact of future fleet and trading pattern changes on port infrastructure requirements.
- Completion of the National Freight Transportation and Logistics Model, which will provide planners with the ability to identify potential infrastructure constraints and allow for the testing of options to address the constraints.
- Initiate development of a port productivity program designed to assist U.S. ports in enhancing their marine terminal productivity and facility utilization.
- Develop analytical methodology for assessing the security vulnerabilities of marine terminals.
- Examine the special problems and future role of small and modern-sized U.S. ports.
- Examine the issues associated with competition between U.S. ports and regional economic efficiency and cooperation in planning.

New Rail Vehicles & Infrastructure (FTA)

FY	1997	1998	1999
Funding	200	800	NA
FTE	NA	NA	NA

Transit agencies operating rail above grade and in subways find it difficult to provide greater capacity, and agencies developing new starts are continuing to experience cost overruns. Studies have shown that communication-based train control systems provide greater throughput at far less cost than infrastructure expansion. Other future benefits of this technology are grade crossing protection, real-time customer information, and commercial adaptation by freight railroad companies (which should lower cost to transit operators). Projects

participating in the FTA Turnkey Demonstration Program are already starting to demonstrate the cost control and financing benefits of the turnkey method of infrastructure project delivery.

FY 1998 activities will include offering technical support in completing development and deployment of the advanced technology train control system, exploring other uses of communication-based technologies including improving commuter rail safety, initiating the update of the subway environmental design handbook based on testing completed at the Memorial Tunnel test site in West Virginia, providing further support to the Turnkey Demonstration Program, and assisting with implementation of the FTA Innovative Finance Initiative.

Pipeline Safety Research (RSPA)

FY	1997	1998	1999
Funding	1,644	1,648	NA
FTE	NA	NA	NA

RSPA's Pipeline Safety Research program provides technical competence to assess pipeline integrity, determine ways to rehabilitate or rebuild pipelines, and set long-term performance goals for improvements. Current research activities include:

- Information Systems - Facilitating risk-based planning through the integration of operator compliance systems with incident and other operational data bases; improving wide area network links to resource availability, operator safety measures and recommendations for regulatory development; and testing applications of a national pipeline mapping system.

- Research Studies - Completing evaluation of leak detection system performance; evaluating pipeline design and operating criteria, including leak before rupture, fracture mechanics, and pressure limitations; and modifying existing nondestructive diagnostic technology used to detect wall thinning to detect external dents and flaws caused by external forces.

- Compliance - Completing an assessment of the degree to which tanks meet American Petroleum Institute (API) standards.

- Management and Analysis - Redesigning risk prioritization processes to focus on field practices.

Major FY 1998 products and milestones will include:

- An evaluation of the first year of expert information systems operations and strategic plan for improving analytical capabilities.

- A study of steel strength and toughness limitations.
- A study of plastic and composite distribution gas piping technology.
- Testing of the second generation risk prioritization model.

CHAPTER 3

INFORMATION INFRASTRUCTURE

Introduction

The importance of timely, accurate and complete information to effective transportation planning and operations has become undeniable in recent years. New communications and information systems technologies are developing rapidly, and there are unprecedented opportunities for making substantial improvements to transportation through their effective implementation.

In order to capitalize on the potential advantages of these new technologies, the Department of Transportation has established as a strategic goal to *"Create a new alliance between the Nation's transportation and technology industries to make them both more efficient and internationally competitive."* [Strategic Goal #3 in the Department's *Strategic Plan*]. This goal envisions a future intermodal transportation network in which each mode uses information systems and technologies to operate more effectively, both by themselves and as an integral part of the larger, seamless transportation system for moving people and goods safely and efficiently throughout the United States and to and from foreign destinations.

This vision for the future of transportation has striking similarities with depictions of the evolution of the National Information Infrastructure, or the NII. In fact, the direct parallel between effective transportation and effective communications services has been pointed out by noting the NII can "have the same effect on U.S. economic and social development as public investment in the railroads had in the 19th century." [Federal Interagency Information Infrastructure Task Force, The National Information Infrastructure Agenda for Action", September 1993]. There has already been discussion of the advantages of defining a 'Transportation Information Infrastructure' or 'TII', to encompass those components of the NII whose primary purpose is to expedite the flow of passengers and freight on the National transportation system. If this concept were adopted, then the Federal government and the Department of Transportation would have significant and important new responsibilities.

However, a coordinated and comprehensive Federal approach to managing this intersection of transportation and communications has yet to be formulated. This would be a complex endeavor that would need to address a number of topics, such as:

- the need to support large numbers of both mobile and fixed users and platforms;
- the need to transmit significant amounts of data in real-time or near real-time;

- the need for seamless inter-connectivity among communications modes (wired, wireless, hybrid) and regions, both nationally and internationally, including managing the allocation and use of communications spectrum;

- the need for high reliability and survivability for safety-critical and National security-related applications; and

- the need to ensure compatibility among the regulations, legislation and administrative procedures of numerous public authorities at the local, regional, state, National and international levels.

Even given these daunting parameters, it is in fact possible to integrate state-of-the-art communications and information systems technologies into transportation. In many ways, the Intelligent Transportation System (ITS) program, previously known as Intelligent Vehicle Highway Systems (IVHS), is a model for the advantages that can accrue when the latest information and communications technologies are applied to transportation.

Intelligent Transportation Systems (ITS)

The ITS program arose in the late 1980s out of an awareness that parallel advances in such fields as electronics, communications, control, and information processing technologies offered a unique opportunity to make profound improvements in the Nation's surface transportation system. The ITS program seeks to apply these technologies in a manner that will enable the public to use the Nation's surface transportation infrastructure and energy resources to help achieve multiple goals simultaneously, including: improved safety, increased efficiency of transportation operations, reduced environmental and energy impacts of transportation activities, enhanced economic productivity, and enhanced mobility for transportation users.

The Federal Government is only one, although a major, participant in the National ITS program. Other players include private electronics, communications, and transportation technology companies; professional societies and organizations; consumer and industry groups; academia; and State and local governments. In addition, the Intelligent Transportation Society of America, or ITS America, is utilized as a Federal Advisory Committee to advise the DOT on the ITS program.

The primary role of the Federal Government, and of DOT in particular, in this program is to assure the development and deployment of a truly compatible, nationwide ITS system. This is accomplished through a number of coordinated activities. DOT encourages and coordinates the development of uniform technologies, standards, and associated knowledge bases. Because of its statutory mandate, the Department also provides a National emphasis and perspective on the safety aspects of ITS. It funds high-risk research that has the potential for a significant

public benefit, but is not sufficiently attractive for the private sector to pursue. It also plays a major role in ITS operational tests, technology assessment, and program planning.

Within DOT, the Joint ITS Program Office, or JPO, is housed in the FHWA and reports to the ITS Management Council chaired by the Deputy Secretary, and consisting of the administrators of FHWA, NHTSA, FTA, FRA, and FAA, as well as to the General Counsel, the Assistant Secretary for Transportation Policy, and the Assistant Secretary for Budget and Policy. The JPO coordinates the Department's overall ITS activities within FHWA itself, NHTSA, FTA, FRA, RSPA, and OST. Other Federal organizations with significant roles in the ITS program include the Departments of Treasury, Commerce, Justice, and Energy; the Federal Communications Commission, the Environmental Protection Agency, and the National Laboratories.

The Department's ITS program has already achieved a number of significant accomplishments. It has cooperated with ITS America to produce a *National ITS Program Plan* in March 1995, and has developed a coordinated set of "road maps" that mark milestones and critical paths for achieving program objectives. It has stewarded 77 operational tests that have demonstrated the viability of "first generation" ITS technologies and services. It has launched an aggressive short- and long-term research program that has moved technologies largely unfamiliar in transportation five years ago into actual use. It has identified institutional barriers to ITS implementation, and proposed solutions to remove those barriers and mainstream ITS deployment. It has developed a national architecture that can facilitate the integration and interoperability of ITS user services. It has identified and promoted technical standards that assure hardware and software compatibility. It has created new models of private/public partnerships. It has developed plans to meet educational and human resource needs. Finally, as is discussed below, it has set national goals to encourage widespread ITS deployment.

The Federal Deployment Strategy for ITS

In addition to conducting an ITS research, development, and testing program, Congress directed the Secretary of Transportation to promote the nationwide deployment of ITS to solve transportation problems. In early 1996, the Department announced national deployment objectives to create:

- Infrastructure for metropolitan areas that would integrate nine first-level ITS advanced travel management services. These services would apply to traffic signal control, freeway management, transit management, incident management, electronic toll collection, fare payment, railroad grade crossings, emergency management, and regional multimodal traveler information centers.

- Commercial Vehicle Information Systems and Networks (CVISN) that would form a communications and information backbone to support and integrate ITS services that aid commercial motor carrier operations.

The Department also expects to create an intelligent transportation infrastructure that would enrich and improve transportation services in the Nation's diverse rural communities. The Department formed these deployment objectives gained from the program's extensive research over the past five years, which indicate that smart transportation systems are technically viable, that ITS offers demonstrable benefits, that user acceptance of ITS user services is growing, that institutional barriers pose the greatest challenge to ITS deployment, that deployment is happening in an narrowly focused and disconnected fashion. These findings collectively reinforce the advantages of having a set of 'core infrastructure' elements in place in different regions throughout the Nation. Once installed, these elements would generate for public awareness the real safety, security and congestion benefits of ITS technologies. They would also serve as the foundation for the deployment of more advanced ITS features as they became available. In order to save time, save lives, and improve the quality of life for all Americans, the Department plans to facilitate deployment of intelligent transportation infrastructure in the following areas:

- Metropolitan -- Full implementation, including advanced travel management systems and advanced public transportation systems capabilities, in 75 of the largest metropolitan areas in the Nation within 10 years.

- Commercial Vehicle Operations -- Deployment of CVISN to achieve safe and efficient shipping operations and enable electronic business transactions by the year 2005 in all states.

- Rural -- Upgrade technology in 450 other communities, rural road, and the National Highway System as warranted.

A range of activities are underway in support of these goals. The Model Deployment Initiative has chosen four urban sites that will become models for other metropolitan areas to emulate as they plan the deployment and implementation of an integrated, fully functioning advanced travel management system. The ITS program will also support continuing standards development and professional capacity building activities. The Department has formed partnerships with Maryland and Virginia to prototype the CVISN technologies and demonstrate and refine the operational concepts. In 1997, the Department will launch seven CVISN pilots or model deployments, all of which have now been selected, of electronic data interchange, clearinghouses, Safety and Fitness Electronic Records (SAFER), and state systems compliant with CVISN architecture. The Department is developing a strategic plan to achieve the rural goals for ITS, and plans to facilitate the near-term deployment of an integrated rural travel management system that will provide emergency management services, traveler information, and safety and hazard warnings unique to the requirements of rural drivers.

Future Directions for ITS

As was mentioned previously, the Department's ITS program can already claim a number of successes. As the focus of the program moves from planning and R&D increasingly to the more complex stage of implementation, however, new themes will come to dominate the Department's activities. Over the next several years, the following themes are expected to become prominent, and are reflected in the Department's ITS plans:

- accelerating the installation of advanced travel management systems and CVISN at the state and local level through deployment incentives;
- field testing new technologies such as crash avoidance systems and advanced vehicle control and information systems;
- refining ITS system architecture and developing technical standards; and
- training the "next generation" of transportation planners, engineers, and managers, to provide the professionals needed to design and build future intelligent transportation systems from a systems integration perspective.

In addition to these major themes, a number of issues will need to be discussed and resolved in order to maintain the momentum of the ITS program. For example, there are important questions over the wireless spectrum needs of a fully installed ITS network and guaranteeing that the requisite bandwidth will be available when it is needed. There is also concern from the private sector over the impact of publicly-owned wireline communications systems, especially those based on fiber optic cables, that may support ITS but have considerable excess capacity that could be offered or sold to other users. Finally, responsibility for the effective long-term maintenance of the vast array of software, system architecture and technical standards generated by ITS, and resident in a number of separate public and private sector organizations, must be confirmed. The Department is taking action in each of these areas to begin the process of addressing and resolving these concerns.

NHTSA Collision Avoidance Research

The Collision Avoidance Research program, administered by NHTSA, seeks to facilitate the identification and development of effective safety-related ITS products and systems that will contribute to a safer driving experience for all highway users. In pursuit of this goal, it is envisioned that a wide variety of innovations can be implemented to supplement the driver's ability to maintain vigilance and effective vehicular control. These innovations -- many of which will rely on state-of-the-art communications, information systems and sensor technologies -- would monitor the drivers' own physiological condition, enhance perceptions

of the driving environment, provide additional information about potential safety hazards, warn of impending collisions, assist in making appropriate vehicular maneuvers and even intervene with automatic controls to help avoid such collisions. Thus, the collision avoidance program supports a number of the Department of Transportation's major goals, including: contributing to the National economy, advancing U.S. technology, and supporting the safety of the transportation system.

The collision avoidance program is pursuing a multifaceted research and development effort incorporating five major thrusts:

Thrust #1 Develop research tools such as portable data acquisition systems that can be installed in vehicles, and utilize these tools to develop a better understanding of driver-vehicle interactions and in estimating safety benefits of potential countermeasures concepts.

Thrust #2 Conduct detailed analysis of crash databases, develop descriptions of specific crash problems to be addressed (road departure, rear-end, lane change/merge, backing, etc.) and identify potentially promising countermeasures for further research.

Thrust #3 Develop performance guidelines for countermeasures associated with these crash categories, as the basis for developing crash avoidance systems.

Thrust #4 Work cooperatively with private industry and research institutions to facilitate the commercial development of promising crash avoidance systems.

Thrust #5 Assess the safety of ITS mobility- and productivity-enhancing systems to make sure they do not degrade safety.

The NHTSA collision avoidance program addresses the collision problems in three countermeasure areas, focusing on countermeasures for specific collision types, system approaches that enhance driver performance under certain situations, and approaches for mitigating the consequences of collisions. Over the next five years, several activities will receive increased emphasis: rear-end collision avoidance, intersection/railroad collision avoidance, single vehicle road departure collision avoidance, lane change/merge collision avoidance, heavy vehicle stability enhancement, drowsy driver monitoring, driver vision enhancement, and automated collision notification.

The significant near-term products and current and planned activities of the NHTSA crash avoidance program can be found in the program summaries in this chapter (‘Research and Development--Crash Avoidance’, ‘Operational Tests--Collision Avoidance’, and ‘Crash Avoidance--Driver/Vehicle Performance’), as well as in other chapters of this report (‘Crash

Avoidance Research--Heavy Vehicles' in Chapter 4, and 'National Advanced Driving Simulator' in Chapter 6).

Other Information Infrastructure Programs

In addition to ITS and crash avoidance, other surface and non-surface DOT programs also reflect applications of information technologies to transportation. FRA's Next Generation High-Speed Rail program is funding three positive train control projects which utilize datalink communications and GPS positioning. The Maritime Administration (MARAD) manages an Industry Competitiveness program which places a high priority on the identification of information, communications and navigation systems and technologies that can improve the U.S. maritime industry's competitiveness. The Research and Special Programs Administration's (RSPA) Hazardous Materials Research program relies heavily on the application of information and navigation technologies to support its regulatory enforcement responsibilities. The Response Management Support program, also in RSPA, manages crisis management systems that enable the Secretary of Transportation and senior DOT officials to respond effectively to natural disasters or other National emergencies. Other non-surface transportation activities that have an important impact on surface transportation can be found in the Federal Aviation Administration's Aviation Satellite Navigation program, and the U.S. Coast Guard's work in differential GPS.

Finally, there are several related surface transportation R&D programs with a major information technologies content which are described in other sections of this document. The data collection and analysis and system assessment activities undertaken by the National Highway Traffic Safety Administration (NHTSA), the Federal Transit Administration (FTA) and the Bureau of Transportation Statistics (BTS), for example, are described in Chapter 6 of this section.

Near Term Efforts

The remainder of this chapter presents the Department's near-term program plans for information infrastructure research and development. The Department's ITS research and development is funded through the FHWA budget, under the following broad program titles:

- ITS Research and Development
- Advanced Vehicle Control and Information Systems
- Operational Tests
- Evaluation/Program Assessment
- Architecture and Standards
- Mainstreaming

- Program Support
- ISTEA Section 6058 Funds

It is at this level that budget authority for the ITS program is defined, and the budget data presented in this report reflect that authority. Because several of these funding categories encompass a broad range of specific research activities, in some cases managed by different operating administrations within the Department, this chapter describes the specific activities of the ITS research program at an additional level of detail. The allocation of funds for those specific activities is managed and reported separately by the ITS Joint Program Office (JPO), within the discretion afforded to the Department by statute. The Department's other information infrastructure research is presented using the same approach as in the previous chapter.

Research and Development (FHWA)

FY	1997	1998	1999
Funding	28,605	45,500	NA
FTE	NA	NA	NA

Activities included in ITS Research and Development include: Traffic Management and Control, Crash Avoidance Research, Enabling Research, Rural Research, High Risk Research, Other Research, Advanced Transit Management Research, Commercial Vehicle Operations, and Highway/Rail Intersection Innovative Development Research. Each of these programs is described in detail below.

Research and Development--Traffic Management and Control (FHWA/FTA)

Research in traffic management and control will improve efficiency and mobility by developing improved methods for managing traffic, evaluation tools to support the required investment decisions, interface specifications, and technical assistance to the end users of the products. These products will facilitate the adoption and implementation of advanced traffic management and control techniques by state and local transportation agencies.

Current research activities include:

- Development of a Traffic Research Laboratory (TREL) which is a simulator for the testing and integration of ATMS technologies.

- Field testing of real-time traffic adaptive signal control (RT-TRACS) implementing various control algorithms operating in different geographical locations and under differing traffic conditions.

- Completion of functional requirements for sensors and detectors needed to support ATMS and facilitate the industry-driven development of sensors to meet those requirements.

- Investigation of surface street incident detection issues and achievement of acceptance from the user community for definition of what constitutes a surface street incident.

- Development of a functional design to integrate traffic, planning, and other analytical tools and practices for use by Metropolitan Planning Organizations (MPOs) in the development of Transportation Improvement Programs (TIPs).

Key milestones for FY 1998 will likely include:

- Testing of innovative traffic signal control algorithms for use with RT-TRACS that increase its effectiveness, such as those for surface street mass transit systems or those that allow for forecasting of traffic demand on a network-wide basis.

- Development of the overall design for a prototype traffic analysis tool for use by MPOs in the development of TIPs and provide them with the functionality to assess individual intelligent transportation infrastructure components.

- Integrate transit and APTS capabilities in the development of planning models.

Research and Development--Crash Avoidance (NHTSA)

NHTSA's Crash Avoidance research facilitates the development and deployment of effective collision avoidance systems and other motor vehicle systems using intelligent technologies to reduce the number of collisions, prevent injuries, and improve safety in automobile crashes. This research also ensures that safety is not degraded by new ITS products that may be introduced by automobile manufacturers.

Current research activities include:

- Completion in FY 1997 of development of a System for Assessing the Vehicle Motion Environment (SAVME). This new research tool will provide the capability of quantitatively describing the variety of dynamic vehicle interactions experienced during normal driving and how drivers react to these situations. This information will be useful for defining test conditions and analyzing potential benefits of collision avoidance systems.

- Completion in FY 1997 of the development and validation of the Data Acquisition System for Crash Avoidance Research (DASCAR). This new research tool will provide the capability to perform detailed studies of driver behavior during normal driving operations.

This information will be useful for developing performance requirements for collision avoidance systems and for analyzing the potential benefits of collision avoidance systems.

- Evaluation of the impact on safety of the ADVANCE route guidance and navigation operational test.

- Completion of a cooperative agreement with a consortium of motor vehicle manufacturers and suppliers, focused on cost reduction and advances in manufacturing techniques related to collision avoidance systems.

Key milestones for FY 1998 will include:

- Final performance standards for all major first-generation advanced technology collision warning/avoidance systems will be completed.

- Automated Collision Notification (ACN) operational field test and independent evaluation will be completed.

- Refinement efforts for a commercially viable system for Drowsy Driver Detection in heavy vehicles will be completed.

Research and Development--Enabling Research

Enabling research will contribute to the efficiency, mobility, and personal productivity of transportation through research in human factors and communications and navigation technologies.

Current research activities include:

- Completion of human factors empirical research regarding travelers' information needs and preferences for routing, departure times, and rerouting information, as well as research concerning the structure of routing messages, driver routing and rerouting decision sequences.

- Delivery of guidelines and user requirements for augmentation of the Global Positioning System (GPS) for surface transportation users.

- Development of a model of electromagnetic compatibility used to develop guidance on the compatibility of ITS devices in a roadway environment.

Key milestones for FY 1998 will likely include:

- For the In-Vehicle Information System behavioral model and support system effort, the system specification document, the human computer interface specification, and the software specification will be completed.

- Technical support of the ITS petition to the FCC for a spectrum allocation from 5850-5925 MHZ, and uncluttered and relatively clear band, for short-range communications.

- Demonstration that the Dedicated Short Range Communication (DSRC) equipment will not interfere with satellite communications equipment, which will be sharing a "co-primary" status with DSRC if FHWA's petition to the FCC is granted.

Research and Development--Rural Research (FHWA)

The Rural ITS Research and Development program has been focused on a limited group of projects that are required to ultimately enable public and private agencies to deploy a set of user services that will reduce rural traffic fatalities, increase use and availability of rural transit, and increase rural transportation efficiency.

Current research activities include:

- Evaluating satellite communications systems for Mayday applications.

- Assessing the needs of rural transit operators and transit users.

- Assessing the institutional and technical issues of some of the Rural ITS service groupings.

Key milestones for FY 1998 will likely include:

- Completion of the second of two field projects recommended and conducted under the "Rural Applications of ITS" contract. This consists of the measurement and transmission of real-time delay information to a portable changeable message sign (CMS) at a work zone.

- Initial resolution of some of the critical issues identified in the first assessment of Rural ITS groupings.

Research and Development--High Risk Research (FHWA)

FHWA's High-Risk ITS Research promotes innovative operational and/or analytical tests which have significant potential to help accomplish long-term goals established by the ITS Strategic Plan but do not attract substantial non-Federal commitments because of the level of risk involved.

Major activities for FY 1997 include:

- Completion of 10-15 projects under the *Innovations Deserving Exploratory Analysis* (IDEA) program, with some portion resulting in the successful marketing of an ITS product.

- Completion of approximately 30 research projects on various ITS-related topics.

This research program will end in FY 1997.

Research and Development--Other Research (FHWA)

For a number of otherwise unclassified essential activities and service functions directly related to the ITS research program, fundamental research of a longer term nature is planned, focusing on areas of safety and mobility as they relate to efficiency.

Current research activities include:

- The three ITS Research Centers of Excellence successfully completed their five year ITS research programs, as evidenced by the establishment of continuing programs of ITS funding independent of the Federal grant.

- Five new ITS IDEA products successfully reached the marketplace. Ten other grants were completed. Twenty new IDEA projects were funded.

Key milestones for FY 1998 will likely include:

- Award of three Research Centers of Excellence grants.

- Direct user input on new technology under development as to its ability to meet customer expectations.

Research and Development--Advanced Transit (FTA)

By the very nature of its route structure, fixed route public transit serves a limited segment of the population. It is therefore difficult to expand ridership within that limited market. This research will provide an approach to expand the available market in a cost-effective manner. The objective will be to increase transit ridership by, for example, identifying the degree to which buses should most cost-effectively deviate from fixed routes to serve new customers.

Current research activities include:

- Development of the capability to integrate a vehicle diagnostics system with an existing AVL/CAD (Automated Vehicle Location and Computer Aided Dispatch) system to optimize the potential of the vehicle's wireless data network.

Key milestones for FY 1998 will likely include:

- Guidelines for specifying and deploying flexibly routed fleet management systems with capabilities to include: deviation and flexible routing; real-time passenger counting systems; and guidelines for specifying and deploying flexibly routed fleet management services.

Research and Development--Commercial Vehicle Operations (FHWA)

Commercial Vehicle Operations (CVO) research is focused on SAFER and CVISN activities, which will lead to advanced technology to achieve safe and free movement of trucks and buses throughout North America, and to streamline the regulatory process.

Current research activities include:

- Model deployment of a CVISN system with the capability to support roadside electronic verification and one-stop purchase of credentials.

- Electronic clearinghouses for the International Registration Plan and International Fuel Tax Agreements.

- Software to support carrier-to-State and State-to-State electronic data interchange (EDI) for credentials.

Key milestones for FY 1998 will likely include:

- States deploying CVISN in FY 1998 will have received central support to assist in the software linkages and other technical assistance necessary for successful deployment.

- Completion of the "black box" being developed by Sandia National Laboratories to aid in understanding commercial motor vehicle crashes.

- Completion of the CALSPAN project on visual imaging technology, used to automate the measurement of brake push rod travel in brake testing, reducing the need to employ the manual processes used by inspectors.

Research and Development--Positive Train Control Systems (FRA)

This FRA research effort will explore advanced communication system technologies, and develop and operationally test cost-effective train control systems with the potential to significantly reduce highway-rail intersection (HRI) hazards while minimizing disruptions to highway and rail users.

Current research activities include:

- Complete evaluation of Vehicle Proximity Alert Devices from tests in actual railroad corridors. Summarize each system's strengths and weaknesses and provide suggestions for improvements.

- Continue evaluation of Positive Train Control (PTC) systems in Illinois and Michigan, and of the Positive Train Separation (PTS) system in the Pacific Northwest.

- Evaluate system compatibility between PTS and highway-traffic management systems in the Pacific Northwest high-speed corridor.

Key milestones for FY 1998 will likely include:

- Demonstrate an interactive intermodal traffic control system using the real-time, continuously updated train location data available as a result of implementing advanced communications-based train control systems. Demonstrate that train control and highway traffic management systems correctly communicate with each other.

- Evaluate the effectiveness of techniques such as existing active standard highway traffic signal devices, intersection video surveillance, remote monitoring of detection equipment integrity at grade crossings, traffic advisory and active roadside message devices, devices capable of full blockage of HRIs when necessary for safety, and automated collision avoidance and notification systems.

Automated Vehicle Control and Information Systems (FHWA)

FY	1997	1998	1999
Funding	22,000	26,000	NA
FTE	NA	NA	NA

The Automated Vehicle Control and Information Systems (AVCIS) program is a broad program area which includes the work that has been previously undertaken in the Automated Highway System (AHS) program. The change in program title reflects the emerging focus of current AHS efforts and the focus of the Department on the goal of developing an integrated, human-centered intelligent vehicle which can enhance driving performance and travel efficiency and substantially reduce accidents. In future years, other ITS program work which contributes to this goal (e.g., collision avoidance research and operational tests) will be included in this program area.

Section 6054(b) of the ISTEA legislation established as a goal that the Department of Transportation develop an automated highway and vehicle prototype and demonstrate its feasibility by 1997. In pursuit of that goal, the Department of Transportation entered into a cost-shared cooperative agreement with the National AHS Consortium (NAHSC) in October 1994. Core consortium members include Bechtel, the California Department of Transportation, Carnegie Mellon University Robotics Institute, Delco Electronics, General Motors, Hughes Aircraft, Martin Marietta, Parsons Brinkerhoff, and the University of California Partners for Advanced Transit and Highways (PATH) Program. The NAHSC is responsible for specifying, developing and demonstrating a prototype AHS. That demonstration will take place in the first week of August 1997 on a 7.6 mile stretch of I-15 near San Diego.

This demonstration represents an important milestone in the Department's collaboration with industry to investigate the feasibility of the Automated Highway. However, the Department's social and institutional investigations indicate that it would be unrealistic to pursue an approach that involves new, exclusive rights of way dedicated to automation. Full automation is likely to evolve incrementally from an increasingly intelligent vehicle. This has focused much of the effort on the incremental components of an intelligent vehicle and their user-friendly integration.

An important outcome of the above-mentioned demonstration will be a tighter focus on nearer term features that enhance driving performance and the human factors that are involved with the driver interface. The AVCIS effort is currently a complement to and will ultimately include the ITS Crash Avoidance Program. It extends the benefits achieved from the crash avoidance effort through application of vehicle-to-vehicle and limited vehicle-to-roadside communication and cooperation. Given a shorter focus and the expectation of marketable products, it may be appropriate to have the private sector assume a larger share of the partnership.

Currently, the AHS program is conducting numerous research, development, and testing activities, examples of which include:

- In FY 1997, successful demonstration of AHS proof-of-technical-feasibility will be a major national event showcasing the potential of vehicle-highway automation for 21st century transportation. The demonstration will be conducted on HOV lanes located in the median of I-15 in San Diego, and will integrate basic collision avoidance capabilities with new capabilities in automated vehicle control, with the vehicles and the highway cooperating as a unified system.

- A comprehensive set of institutional/social analyses will yield guidelines for deployment of AHS with respect to land use and sustainable development, an assessment of regional air quality improvements resulting from AHS implementation, guidelines for integrating AHS as a new capability into the transportation planning process, recommendations as to optimal public/private roles in deployment and operations, assessment of AHS operations and maintenance impacts, recommended strategies for mitigating liability, and cost/benefit assessments of AHS concepts.

- Enabling technology R&D is an ongoing activity upon which development of the ultimate AHS prototype will be based. Specific tasks that will be completed in FY 1997 include: initial forward-looking radar build decisions, short-range radar test results, stereo processing for lane and obstacle detection, blind spot sensor test results, color video sensing test results, and definition of critical software validation methods.

Key milestones for FY 1998 will include:

- Continued development of enabling technologies.

- Detailed assessment of user demand and other societal and institutional investigations.

- Results of site-specific case studies.

- Evaluation of the most promising concepts.

- Construction and testing of critical subsystems of the most promising concepts.

The Department of Transportation is in the process of merging all vehicle-focused ITS activities into a multi- agency research and development program, which will be entitled the Intelligent Vehicle Initiative (IVI). The IVI will emphasize the significant and continuing role of the driver in highway safety.

Operational Tests (FHWA)

FY	1997	1998	1999
Funding	54,992	24,500	NA
FTE	NA	NA	NA

ITS Operational Tests address the following areas, each of which are described below in detail: ATMS/ATIS, APTS, CVO, Collision Avoidance, Rural Tests, and Model Deployments.

Operational Tests--ATMS/ATIS (FHWA/FTA)

The goal of ATMS/ATIS Operational Tests is to investigate and evaluate various travel management and technologies standards in a field environment to determine their ability to be integrated, successfully implemented, and to operate with various existing systems and technology.

Current research activities include:

- Testing and integration of various R&D products and standards in a field research test environment, including RT-TRACS and map database standards.

A key milestone for FY 1998 will be:

- Testing of various additional technologies and standards in a field research test environment.

Operational Tests--APTS (FTA)

The goals of FTA's APTS Operational Tests are to extend the benefits of Automated Vehicle Location and Computer Aided Dispatch (AVL/CAD) to small suburban and rural transit operators, and to demonstrate the viability of smart cards that combine the contactless read/write capability desired for transit operation with the contact approach suited for commercial bank cards.

Current research activities include:

- Implementation of Transit Variable Message Sign operational test.

- Implementation of Next-Generation Kiosk and Transit Information operational test.

- Implementation of Advanced Fare Media operational test.

- Implementation of Advanced Fleet Management operational test.

Key milestones for FY 1998 will include:

- An operational test of a Regional Fleet Management system, shared by a number (20-30) of transit agencies within a given region.

- An operational test of a hybrid bank-proximity card.

Operational Tests--Commercial Vehicle Operations (FHWA)

This operational test will bring together individual operational tests such as smart cards, data recorders (black box), emissions checking, and electronic braking systems and link them into a comprehensive system that will warn the driver of faulty systems and send critical information to the roadside to facilitate the electronic inspection of vehicles. The expectation is to allow the driver to voluntarily take a commercial vehicle out of service prior to a mandate by a public safety official, and to improve the vehicle throughput by bypassing the manual inspection process. The test is also expected to develop a drowsy driver detection system that will continuously measure and record driver performance, and using an early warning system to reduce crashes.

Current research activities include:

- Pilot testing the use of onboard sensors and diagnostics to expedite roadside safety inspections of drivers and vehicles.

- Development of a prototype for integrating Smart Card technology, especially for driver safety information.

- Operational tests at the Nogales, Otay Mesa, Santa Teresa, Buffalo, and Detroit border crossings. Border crossing projects in Laredo and El Paso are already underway. Documentation of costs, benefits, and institutional solutions. Refinement of site designs and recommendations for automation at additional crossings.

Key milestones for FY 1998 will include:

- Demonstration of on-board vehicle diagnostics, providing the capability to warn the driver of faulty systems such as lights and brakes, determine compliance status of the carrier, verify emissions at high and slow speeds.

- Assessment of the factors that contribute to commercial motor vehicle accidents and development of applicable monitoring technologies.

- Integration of lessons learned from smart card, black box, and electronic braking operational tests, and development of a pilot model to allow for electronic inspections and driver warnings.

Operational Tests--AVCSS (NHTSA)

NHTSA's operational testing of Advanced Vehicle Control and Safety Systems (AVCSS) facilitates the development and deployment of effective collision avoidance systems and other motor vehicle systems using intelligent technologies to reduce the number of collisions, and ensures that safety is not degraded by new ITS products that may be introduced by automobile manufacturers.

Current research activities include:

- Actual on-the-road testing and data collection on 1,000 vehicles equipped with Automated Collision Notification (ACN) systems.

- Actual on-the-road testing of 10 vehicles equipped with Intelligent Cruise Control (ICC) systems.

- Initiation of on-the-road testing, data collection, and independent evaluation of heavy trucks equipped with ICC.

Key milestones for FY 1998 will include:

- Completion of ACN and ICC Operational Test independent evaluations.

- Continuation of testing, data collection, and evaluation of ICC-equipped heavy trucks.

Operational Tests--Rural (FHWA)

Rural operational testing by FHWA will evaluate the technical and organizational feasibility of ITS to address user needs in real-world rural environments. Examples of potential test categories include speed issues, weather and safety advisories, rural mobility management, and infrastructure-based road departure avoidance.

Current research activities include:

- Completion of Phase I rural user needs case studies in 10 locations to determine ITS deployment planning needs.

- Provision of technical assistance for rural ITS planning.

Key milestones for FY 1998 will include:

- Completion of the evaluation plan for the field operational test initiated in FY 1997.

- Initiation of up to three additional field operational tests.

Evaluation/Program Assessment(FHWA)

FY	1997	1998	1999
Funding	2,000	9,000	NA
FTE	NA	NA	NA

ITS Evaluation includes both Field Evaluations and ITS Program Assessment, which are described separately below.

Evaluation/Program Assessment--ITS Field Evaluations (FHWA/NHTSA/FTA)

Field operational tests of ITS will focus on assessing improvements as measured in six primary measurement areas: (1) reductions in crashes; (2) reductions in fatalities; (3) increases in throughput, (4) reductions in travel time; (5) improvements in customer satisfaction; and (6) savings in public and private sector costs. In addition, the Joint Program Office (JPO) will be working with DOE and EPA to measure energy and emissions impacts of ITS.

Current research activities include:

- Based on the outcome of FY 1996 ITS Field Operational Tests (FOTs), recommended strategies will be developed for completing existing FOTs and beginning new research and FOTs.

- An ITS Program Assessment Support (PAS) contract is expected to yield approximately 20 field operational test evaluation reports, completed Model Deployment evaluation strategy documents, baseline data collection plans, and the initiation of model deployment baseline data collection.

Key milestones for FY 1998 will include:

- Evaluation strategy reports and baseline data collection plans for FY 1998 operational field tests.

- Evaluation baseline reports for intelligent transportation infrastructure Model Deployment sites, CVISN Model Deployment sites, and the Capital Beltway Traveler Information System Showcase.

- Evaluation of final reports from many of the FOTs.

Evaluation/Program Assessment--ITS Program Assessment (FHWA)

In order to evaluate the effectiveness of the ITS program, FHWA carries out a range of benefits estimation and validation activities. These include: canvassing the public and private sectors for benefits with which refinements may be made to hypotheses regarding the national benefits of ITS in term of the six measures identified above; assessing the value of ITS relative to alternative approaches (e.g., adding lanes to highways, reserving lanes for HOVs during peak travel periods); tracking the deployment of partial and integrated ITS throughout the Nation; and assessing the effectiveness of ITS institutionalization.

Current research activities include:

- Collection of ITS empirical measures, and incorporation into simulation models to project benefits of more widely deployed versions of ITS.

- Establishment of an initial set of hypotheses predicting the effectiveness of ITS in a few important measurement areas, based upon benefits assessments using empirical, statistical, and modeling procedures.

- Expansion of the ITS definition of intelligent transportation infrastructure elements into operational definitions that will enable state and local transportation officials to asses their own progress in deploying the intelligent transportation infrastructure. National progress toward achieving stated policy goals to deploy intelligent transportation infrastructure over the next decade will be reported.

Key milestones for FY 1998 will include:

- Documentation of early benefits and lessons learned from case studies of the design, building, and early implementation phases of Model Deployment sites.

- Completion of modeling predictions of ITS effects in Model Deployment site areas, based upon baseline data collected in FY 1997 and FY 1998.

- Analysis of questionnaire data on early indicators of customer satisfaction with CVISN and intelligent transportation infrastructure Model Deployments.

- Publication of a refined set of hypotheses regarding quantitative goals for the effectiveness of ITS.

- Completion of a longitudinal study of economic benefits of ITS across select U.S. cities.

Architecture and Standards (FHWA)

FY	1997	1998	1999
Funding	5,000	13,000	NA
FTE	NA	NA	NA

ITS Architecture and Standards provides for the development of ITS Architecture and ITS Standards, discussed below in detail.

Architecture and Standards--Architecture

In order to ensure the rapid and widespread deployment of ITS systems and components on a nationwide basis, an ITS National System Architecture was completed in July 1996, describing how the various ITS systems and components will smoothly interact with each other. This architecture, which is to be developed as a fully consensual process, will guide -- and not mandate -- consistent decisions among investors, producers and purchasers of ITS products and services so that the risk of incompatibility is minimized. 1997 is the trial year for getting the architecture out into the hands of implementors. Until such time as all the required standards are published and catalogued to provide implementors with appropriate technical direction, revision of the technical information in the architecture will provide an important design reference for cities and states, and will help to insure that current implementors don't repeat the mistakes made by earlier adopters.

Current research activities include:

- Assisting standards development organizations in the development of ITS standards. Providing insight into national/regional interoperability aspects of the architecture standards requirements documentation.

- Completion and distribution of the ITS user documents. Support to Model Deployments to ensure adherence to the national architecture.

- Incorporation of the Highway-Rail Intersection user service into the national architecture documentation.

Key milestones for FY 1998 will include:

- Assisting standards development organizations (SDOs) in the development of ITS standards that were identified in the national architecture.

- Continuing the update of the architecture as a result of deployment experience.

- Beginning translation of the maintenance of the architecture to the appropriate standards organization. Development of an architecture maintenance transition plan to effect ITS interface definition maintenance to the standards development community.

Architecture and Standards--Standards (FHWA/FTA)

The objectives of the standards program are to provide an environment in which public sector agencies and others have multiple vendors from which to choose; to promote the creation of an ITS market through interoperability of multiple vendor products; to ensure safety through standards for human factors and operational guidelines; and to facilitate the deployment of integrated systems.

Current research activities include:

- Making a wide range of ITS standards available for operational use, examples of which include: a protocol for dedicated short-range communications (DSRC); Electronic Data Interchange (EDI) standards for roadside electronic verification and purchase of credentials; and standardized message sets for automatic vehicle identification, vehicle navigation, and Mayday messages.

- The National Transportation Communications for ITS Protocol (NTCIP) will deliver the final message format specifications for traffic signal control and variable message sign devices, as well as complete initial message format specifications for roadway weather information systems, closed circuit television, and highway advisory radio devices.

- Initiation of approximately 10 additional activities in the areas of message set and foundation standard identified as high priority areas by the architecture.

Key milestones for FY 1998 will include:

- Initiation of activities for the remaining message set standards currently defined by the architecture.
- Provision of approximately 10 additional standards for operational use.
- Assistance in training public sector agencies in the utility and use of the ITS standards.
- Requirements for standardizing the efficient processing of time-varying transit information on a Geographic Information System (GIS).

Mainstreaming (FHWA)

FY	1997	1998	1999
Funding	0	22,000	NA
FTE	NA	NA	NA

ITS Mainstreaming activities will include: Technical Assistance, Planning/Policy initiatives, Training, and Awareness and Advocacy. Mainstreaming activities in each of these areas are discussed below.

Mainstreaming--Technical Assistance (FHWA/FTA)

DOT has been assisting state and local officials and private sector participants in the development of plans for "early deployment" of ITS products and services for commercial vehicle safety regulations and travel management. In the CVO area, this has included supporting states in the development of CVO deployment business plans, holding regional forums and supporting institutional and technical studies which help the CV community -- both public and private -- to understand ITS programs and benefits and be prepared to incorporate them into their ongoing activities.

Technical assistance related to mainstreaming includes transferring the results of ITS research and development, operational tests, and Model Deployment efforts; sharing the lessons learned in overcoming institutional barriers and enhancing interjurisdictional cooperation; and providing national leadership in the reengineering of current business practices by States and motor carriers.

Current technical assistance activities include:

- Establishment of the ITS Assistance Network (ITSAN) designed to provide "real world" technical assistance through a "peer-to-peer" information exchange on intelligent transportation infrastructure deployment issues and problems associated with state and local agency technical personnel in both highway and transit fields.

- Provision of direct technical assistance to transit authorities in the design, development, procurement, and implementation of ITS. Completion of preliminary investigation and data collection on the integration of transit fare collection and stored value bank cards.

- Completion of study of legal, security, and privacy issues related to CVO, especially onboard systems.

Key milestones for FY 1998 will include:

- Showcasing intelligent transportation infrastructure components and integrated systems at the Model Deployment sites to elected officials and transportation professionals through a variety of scanning reviews and "distance learning" information sessions.

- Provision of technical guidance to border States as they implement the international border clearance program.

- Presentation of approximately 70 seminars and workshops covering lessons learned and best practices, along with technical project guidance.

Mainstreaming--Planning/Policy (FHWA)

Planning initiatives are undertaken by state and local governments in 40 metropolitan areas to enhance system performance through the integration of system planning and system operations. By providing technical, best practices and guidance materials to over 400 state and local planning organizations, FHWA can facilitate the consideration of ITS and congestion management options within the context of regionwide multimodal transportation planning.

Current activities include:

- A pilot effort to provide funding to two metropolitan planning organizations (MPOs) and one state transportation department to support the startup of regionwide congestion mitigation and system operations initiatives.

- A guidebook to expand the capacity of MPOs to consider the mobility impacts of accident/incident-induced congestion and the ITS-related tools available to speed response and clearance activities.

- Updating *Integrating Transportation Planning and ITS--An Interim Handbook* to provide better ITS effectiveness evaluation tools.

Key milestones for FY 1998 will include:

- Initiation in 40 areas of a program supporting local initiatives to merge transportation system operations with the system planning functions.

- Development and distribution of rural intelligent transportation infrastructure program guidance materials.

- Availability to state and local transportation planners and decision makers of information on the costs, benefits, and impacts of deploying congestion management and intelligent transportation infrastructure strategies.

Mainstreaming--Training (FHWA/FTA)

ITS Mainstreaming activities include an intensive and focused ITS training program for professional capacity building to state and local transportation personnel. The objective is to train public sector professionals to a level of expertise commensurate with their duties and responsibilities in the planning, design, implementation, operation, and maintenance of current and future ITS projects.

Current training activities include:

- Development of a five year business plan for implementing the training objectives set forth in the Strategic Plan for ITS Professional Capacity Building.

- Pilot testing and presentation of two ITS short courses: “Transit Management Systems” and “Regional Transportation Information Systems”.

- Training for States/carriers on how to automate the collection, reporting, and auditing of electronic mileage and fuel records by State.

Key milestones for FY 1998 will include:

- Initiation of delivery of training to over 4,000 state and local officials and transportation professionals over a two year period.

- Provision of 100 university scholarships to encourage young professionals to enter ITS-related fields and seek employment in Federal, State, and local transportation management agencies.

- Provision of ITS technician training modules, supporting professional certification programs through "distance learning" and computer-based techniques to those who cannot afford to travel to receive needed training.

Mainstreaming--Awareness and Advocacy (FHWA/FTA)

This ITS activity increases the awareness, involvement, and understanding of ITS--its benefits, its capabilities, and its operations--among public officials, stakeholder groups, and the general public.

Current awareness and advocacy activities include:

- Provision of ITS support information, presentations, and other material to assist field offices in their efforts to promote deployment of intelligent transportation infrastructure components.

- Support information and ITS advocacy needs and exhibits at approximately 10 major events during FY 1997.

- Delivery of over 100 seminars and short courses on various ITS topics to U.S. DOT headquarters and field office staff during FY 1997.

Key milestones for FY 1998 will include:

- Awareness and advocacy programs will emphasize the capabilities and benefits of intelligent transportation infrastructure systems and technologies in meeting regional transportation needs.

- A major campaign will be initiated to increase public awareness of traveler information services that can be used while considering travel mode options and routes in advance of making routine and special trips.

ITS Program Support (FHWA)

FY	1997	1998	1999
Funding	7,761	10,000	NA
FTE	NA	NA	NA

The Program Support function provides for the central coordinating role of the U.S. DOT in the ITS program. This role includes facilitating the development of a National consensus among public and private sector participants on the goals, plans and progress of the ITS program, as well as ensuring that the various ITS activities receive proper technical review and integration.

This function also supports the Cooperative Agreement with ITS AMERICA, a chartered Federal Advisory Committee, for program planning and assessment; and support for MITRE Corporation to provide the Department with program management and system engineering services in support of the ITS program. Additionally, it provides for information management support, local area network services, and technical and program advice in specific areas such as advanced traffic management system applications and system architecture.

Current program support activities include:

- Technical support on issues relating to standards development and radio frequency spectrum acquisition and auctioning, and analytical work that addresses the benefits and costs of various ITS services.

- Technical and program policy advice on specific topics, including advanced traffic management applications and system architecture development, under service contracts with experts in selected program areas.

Key milestones for FY 1998 will include:

- Activities, both internal and external to DOT, that support development of consensus or decisions on critical ITS program issues.

- Technical review to analyze and coordinate technical information as required in support of the Advance Public Transit Systems Program.

ISTEA Section 6058 Funds (FHWA)

FY	1997	1998	1999
Funding	113,000	0	NA
FTE	NA	NA	NA

Through fiscal year 1997, Section 6058 of ISTEA authorizes the appropriation of up to $113 million per fiscal year for the ITS (formerly, IVHS) Corridors Program established under Section 6056, and for other ITS activities. The ITS Corridors Program is intended to stimulate the application of ITS technologies to corridors in which their application will have particular benefit, and is focused upon those with the following characteristics: (1) high traffic density, (2) severe or extreme nonattainment of U.S. standards for ambient ozone concentration, (3) a variety of transportation facilities, (4) constraints to physical infrastructure expansion, (5) a significant mix of passenger, transit, and commercial motor carrier traffic, (6) complex traffic patterns, and (7) potential contribution to implementation of the Department's Strategic Plan for the ITS program. The allocation of Section 6058 funds to other areas is authorized based on potential improvements in operational efficiency, commercial productivity, safety, and motorist and traveler performance, and on reductions in regulatory burden.

ITS Deployment Incentive Program (FHWA)

FY	1997	1998	1999
Funding	0	100,000	NA
FTE	NA	NA	NA

As is discussed above, the Department has formed an ITS deployment strategy for the next decade which has as its primary goals (1) full implementation of intelligent transportation infrastructure in 75 of the Nation's largest metropolitan areas, (2) deployment of CVISN in all interested states, and (3) upgraded intelligent transportation infrastructure technology in 450 rural communities and the NHS. While it is appropriate that ISTEA provide greater flexibility for local decisions on the operations and enhancements of *existing* systems, these goals represent a new layer of infrastructure that will enable intermodal systems management, to achieve efficiency gains needed to accommodate future travel demand and global commerce. The promise of intelligent transportation infrastructure and CVISN can be realized only if they are implemented as national systems, using common standards and a common architecture.

Full achievement of the Department's goals for intelligent transportation infrastructure and CVISN deployment would require a new annual set-aside of $1 billion. By targeting initial funding of $100 million in FY 1998 towards deployment of integrated intelligent transportation infrastructure and CVO elements in both metropolitan and rural areas, the Federal government can make important progress toward attainment of the critical mass necessary to accelerate standards and meet other program objectives.

GPS Support (FHWA)[12]

FY	1997	1998	1999
Funding	0	2,100	NA
FTE	0	NA	NA

The Department of Transportation has worked with the Department of Defense via the GPS Joint Program Office (GPS JPO) to add an option to the Block IIF satellite contract for a second civil frequency (called L5). The addition of L5 to the GPS satellites will allow civilian users of the system to obtain greater accuracy than available with the existing single frequency. In the area of differential or augmented GPS, a preliminary assessment of the technical feasibility of expanding the USCG system to cover the remainder of the U.S. has been completed, and a final report will be completed shortly. Work on an implementation plan has also commenced.

The funds requested for FY 1998 represent half of the estimated cost in FY 1998 to perform this work.

Crash Avoidance--Driver/Vehicle Performance (NHTSA)

FY	1997	1998	1999
Funding	1,000	1,000	NA
FTE	2.0	2.0	NA

This program's goals are to help drivers of all types of vehicles avoid crashes or to lessen the severity of crashes that do occur by: improving driver direct and indirect visibility; improving tire traction performance; improving vehicle braking, directional, and rollover stability; improving vehicle lighting, signaling, and marking; ensuring compatible driver/vehicle interfaces; developing objective test procedures for collision avoidance systems; and acquiring, archiving, and making available to customers driver/vehicle performance characterization data. Research activities include the following:

- Continue research into the performance of antilock braking systems of light vehicles; assessment of driver reaction and driver feedback to activation of the antilock feature; assessment of brake performance on various surfaces;

- Develop protocols for combining simulator and test track experimental data into objective test procedures that could serve as the basis for performance-based standards or regulations;

[12]GPS Support is classified as a Physical Infrastructure research activity.

- Conduct research into issues associated with vehicle rollover such as developing a methodology for determining critical characteristics of vehicles and developing test procedures for demonstrating the impact on vehicle stability and rollover propensity; and

- Provide support for collision avoidance rule making activities on an as-needed basis.

A key milestone for FY 1998 will be to complete evaluation of the interaction between drivers' actions and antilock braking system performance.

Grade Crossing Research (FRA)

The goal of FRA's grade crossing research activities is to develop, characterize, and demonstrate technologies that can reduce the frequency of accidents at railroad grade crossings. Current priorities include:

- Using driver behavior models to devise improved crossing warning and control systems.

- Demonstrating a comprehensive approach to minimizing hazards on a developing high-speed corridor; testing in-cab warning systems; mitigating poor ride quality and reducing high track-train forces at chronic problem track locations.

For FY 1998, key milestones will include:

- Providing new technologies in grade crossing and noise measurement systems.

- Achieving full corridor coverage for a "Sealed Corridor" demonstration on the Charlotte-Raleigh corridor in North Carolina.

Industry Competitiveness (MARAD)

FY	1997	1998	1999
Funding	0	0	NA
FTE	NA	NA	NA

One of the responsibilities of the Maritime Administration is to foster the development of a competitive U.S. maritime industry that contributes to both the Nation's economic growth as well as important National security goals. A top priority of MARAD's Industry Competitiveness program is to assess and deploy effective and innovative information, communications and navigation systems and technologies that will improve the efficiency, productivity and safety of the National maritime transportation system.

In pursuit of this goal, MARAD has expanded participation by the maritime industry in the Ship Operations and Cargo Handling Cooperative Programs, which facilitate the development and sharing of new technologies in these fields. Both of these government/industry cooperative efforts are industry-led and cost-shared. One current project is the development of an integrated Reliability Availability Maintainability Database (RAM) designed to collect ships' equipment failure/corrective maintenance data. The U.S. maritime industry, and foreign fleets as well, have a worldwide need for such a database which can be achieved only with Government participation and leadership.

This program also assesses advanced information systems designed to improve vessel operating safety and efficiency, and conducts research on innovative cargo handling equipment, techniques and systems. The program has also supported the development of these technologies, such as a shipboard Personal Computer-based training system for ship crews. Finally, designated National Maritime Enhancement Institutes will participate in these activities as appropriate.

Hazardous Materials Research (RSPA)

FY	1997	1998	1999
Funding	1,161	1,167	NA
FTE	2.2	2.2	NA

RSPA's hazardous materials safety (HMS) program is a comprehensive nationwide safety program to protect the Nation from the risks to life, health, property, and the environment inherent in the transportation of hazardous materials by water, air, highway, and railroad; to protect the environment from damage by oil and other pollutants; and to ensure the safe transportation of food. The research and development program provides the technical and analytical foundation necessary to support DOT's regulatory, international standards development, compliance, and emergency response activities in the area of hazardous materials (HM) transportation safety. Current research and development efforts are organized into three program areas:

- Information Systems - Continuing to refine the intermodal database; integrating registration data into the Hazardous Materials Information System (HMIS); and assessing the feasibility of enabling industry to file incident reports electronically.

- Research and Analysis - Completing a general risk assessment of HM transport by hazard class, quantity, and packaging; and completing over 12 projects on a range of specific HM risk assessment and technology issues.

- Regulation Compliance (Testing) - Continuing contractor package testing.

Major milestones for FY 1998 will include:

- An assessment of the technical needs for receiving incident report data in electronic form.
- Analytical support for basic rulemaking activities including preparation of regulatory evaluations and related risk-based assessments.

Emergency Transportation (RSPA)

FY	1997	1998	1999
Funding	68	69	NA
FTE	NA	NA	NA

The Office of Emergency Transportation, located in RSPA, provides the Secretary of Transportation and senior DOT officials with an effective ongoing emergency response capability within the overall interagency context of the Federal Response Plan (the Federal Government's plan for performing disaster assistance missions). The Response Management Support program is responsible for maintaining and enhancing the Department's ability to provide these decision-makers timely information in the event of a crisis. In particular, this effort focuses on the ability to assess the effects of a natural disaster on the National transportation system, as well as effective tracking of the flow of critical relief supplies during the response phase. This activity researches available crisis management software systems, including mapping and communications capabilities, and implements improvements to them.

Related Departmental Activities

Aviation Satellite Navigation (FAA)

The Federal Aviation Administration's Navigation program, includes two major program elements. The first element, Satellite Navigation, supports the operational use of satellite navigation technologies such as the Global Positioning System (GPS) and the International Marine Satellite (INMARSAT) in civil aviation. A number of ITS concepts and systems also utilize GPS for surface navigation and vehicle location purposes. The second element, Navigation Systems Development, identifies and evaluates new navigation technologies and concepts that may be applicable to civil aviation. This includes assessing the feasibility of transitioning from primarily ground-based to satellite-based navigation systems, and contributing to the updating of the Federal Radionavigation Plan (FRP).

Improve Search and Rescue Capability (USCG)

The U.S. Coast Guard is the leader in maritime search and rescue. The speed with which USCG responds, and the effectiveness of its search tools and methods directly affects the probability that it will successfully locate persons and vessels in distress. Recent efforts to improve these capabilities include: evaluation of new laser illuminator technology to increase the effectiveness of night vision goggles; heavy weather tests of GPS/Argos self-locating datum marker buoys used to define search area movement; and a feasibility study of using advanced very high resolution radar satellite image data to provide ocean current surface data for computer-assisted search planning. Near-term priorities include: improved statistical tools for search planning; modeling of multi-sensor searches and multiple searches in the same area; and investigating the potential use of satellite altimeters and wind/wave scatterometers for obtaining near real-time sea surface wind and current data.

Waterways Safety and Management (USCG)

One of the primary responsibilities of the U.S. Coast Guard is to facilitate the safety and efficient use of the Nation's waterways. Towards this end, the USCG's Waterways Safety and Management program investigates and applies new and emerging navigation, communications, display and information systems technologies to marine navigation. These activities include continuing the development and enhancement of the Advanced Vessel Traffic System (VTS), developing a ship transit risk model, as well as assessing new concepts for buoys, navigational lights, and other short-range aids to navigation. The program also supports the implementation of International Maritime Organization (IMO) standards for Electronic Chart Display Information Systems (ECDIS) and Electronic Nautical Charts within the U.S.

Improve Maritime Law Enforcement Capability (USCG)

USCG has a significant role as a law enforcement agency to reduce the flow of illicit drugs and alien migrants to our shores, and to protect our fishing grounds by enforcing national and international fishing laws and agreements. To improve its law enforcement capabilities in an era of increasing sophistication on the part of traffickers, the USCG conducts research to improve its surveillance and vessel search processes, and its nonlethal compliance processes. Specific research activities include: defining capabilities and limitations of candidate remote sensing equipment, developing data fusion techniques for sensor queuing, developing synthetic imagery for fues data from multiple sensors, and integrating data from multiple sensors in a single display for real-time use and decision support.

Command, Control, Communications, Computers, and Intelligence Integration (USCG)

USCG decision makers at all levels of command need timely and accurate information. Advances in information and communications technology provide the opportunity for development of integrated Command, Control, Communications, Computer, and Intelligence

(C4I) systems, which will provide these officials with more timely information through state of the art technology. Specific USCG research priorities in this area include: integrating USCG operational databases, developing future mobile communications requirements, investigating satellite communications architecture for wide area network capability between mobile platforms and shore units, investigating commercial communications initiatives, and developing system simulations of proposed National Distress System (NDS) replacement systems to validate performance and ensure interoperability.